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EDITORS:
J. McCUNN, *M.R.C.V.S., M.R.C.S., L.R.C.P.*
R. LOVELL, *D.Sc., Ph.D., M.R.C.V.S., D.V.S.M.*
SIR THOMAS DALLING, *M.A., D.Sc., F.R.C.V.S., F.R.S.E.*

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EDITORIAL

MAN'S CONCERN FOR HIS ANIMALS

THE disease myxomatosis which has spread throughout the land has been the cause of much disquiet amongst our people. The reports of the piteous state of the affected animals, and these reports have lost none of their verve in the telling, have given rise to great concern and led to vociferous pleas for immediate action to stay the course of this fell disease. This great clamour has emanated from all sections of the community and the most sceptical observer could not fail to be convinced that the British people have a deep and sympathetic interest in their animals be they their companions in the home, their servants in the farms and roads, or the predatory denizens of the woods and fields. It would seem that the British people live not only in some degree of ecological balance with their animals but that there is between them a deep bond of sentiment and love which is expressed to a greater degree in this country than in any other part of the world. It is the latter attribute which has made and proclaimed this country to be the leader in all those laudable projects which portend to foster and nourish the cult of animal welfare. In some countries concern for the welfare of animals arises from material or economic motives but in Britain it is most manifest and rises to a crescendo on those occasions when as a result of human frailty or natural hazard pain or discomfort may occur.

The word "cruelty" is an ominous one for it is presaging of evil but it

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has an omnifarious interpretation. Cruelty varies in degree from that which may be imperceptible to that which can be classified only as diabolical on account of the pain and suffering which is occasioned. There are times when some degree of cruelty cannot be avoided but there are no occasions on which it can be condoned if it is possible to alleviate or avoid it. It is a good thing that the very thought of the perpetration of some act of cruelty should elicit an immediate response in the compassionate hearts of men but there are occasions when this reaction warps judgment and reason and induces in highly sensitive people a state of mental anxiety and distress which can be defined as a form of cruelty inflicted on man. The present epidemic has given rise to many such cases. The lurid accounts of the terminal stages of the disease have been the cause of great sorrow and anxiety in spite of the fact that the period of suffering is relatively short, that a few hours before death the animals are eating and gambolling as usual, and what animal eats and plays if he be in pain, and also that sensation and apprehension in the apparent rather ghastly end are soothed and dulled by a gradually increasing coma.

Rabbits are attractive gentle creatures, we like to see a flurry of white tails when we walk abroad but they are very prolific and they eat a lot of food. In most areas they live in balanced relationship with other wild creatures and their numbers and the damage they do keep within reasonable proportions. In some areas this balance is exceeded, they become a menace to the food supply of man and beast and it is necessary to reduce their number. Whatever method is adopted some degree of cruelty is bound to arise and it is debatable and even doubtful if myxomatosis occasions more pain or suffering than do some of the alternative methods. Sensitive people are inclined to measure animal pain and suffering by human standards. This conception is erroneous. Recognition of this simple fact may bring some degree of comfort to those whose hearts are sorely troubled.

GENERAL ARTICLES

THE WINTERING OF BLACKFACE MOUNTAIN EWE LAMBS

By W. M. BROWNLIE*

Thurgarton, Notts

Introduction

THE provision of suitable winter grazing for ewe lambs selected as stock replacements in hill flocks is a major problem on many farms.

Occasionally the lambs are wintered throughout on the open hill with their dams, but more often they are retained in enclosures during the tupping season and returned to the hill when the rams are removed. Various modifications of this method are used, according to the resources of the farm, and in some instances it has been possible to improve a sufficient area of the lower hill slopes to provide grazing for the lambs right through the winter.

On many hill farms, however, there is no land suitable for improvement at a reasonable cost, and the farmer is faced with the choice of wintering the ewe lambs on natural hill grazings which are much less than adequate for weight maintenance, and where the risk of storm loss may be high, or of sending the lambs off the farm to sheltered lowland grazings.

Both systems, home-wintering and off-wintering, have their advantages and disadvantages but the balance of opinion amongst experienced stockmen is strongly in favour of wintering off the farm.

The main general advantages expected from off-wintering are:—

1. The lambs are wintered under relatively sheltered conditions on better quality grazings and the winter mortality is likely to be low.

2. The number of ewe lambs retained for stock replacement is reduced, culling can be more severe and more surplus ewe lambs are available for sale.

3. The lambs grow larger, are more likely to make suitable breeding sheep as shearlings and they yield a heavier wool clip at the first shearing.

4. The hill stock is reduced in winter and spring when food is scarce, and it may be possible to increase the ewe stock when hill accommodation is no longer required for ewe lambs in winter.

The main advantages claimed for home wintering on hill grazings are:—

1. Full acclimatisation is retained. This is particularly important on hills infected with ticks carrying louping-ill and tick-borne fever. The susceptibility of off-wintered lambs to these diseases on their return to hill grazings is well known. Jamieson (1947), for instance, recorded a loss of over 20 per cent due to tick-borne fever in lambs returned to tick-infested grazings after wintering on tick-free land. Within recent years, however, this aspect of acclimatisation has declined in importance since immunity to louping-ill can be established in the lambs by vaccination before they return to the hill grazings in spring, and though no vaccine is available against tick-borne fever, the use of a good anti-tick dip prevents sudden massive infestation, and in our own experience has enabled

* Research Department, Veterinary Science Division, Boots Pure Drug Co., Ltd.

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sheep, bred and reared on tick-free land, to be placed directly on to heavily infested hill grazings, without loss, during the peak period of tick activity.

2. The lambs are more evenly distributed over the hill since they tend to run with their dams, and they require less herding in their second summer and winter to prevent straying.

3. There is no cash expenditure on winter accommodation. At the present time this is the most important consideration since keep and carriage may cost up to thirty shillings per head.

On some farms the snow hazard is so great that it is almost essential to remove the lambs in winter. In other districts, however, this risk is low, and because of the present difficulty of finding winter accommodation, and its high cost, it has become a common practice to winter the ewe lambs on natural hill grazings.

The following observations were made to discover what benefits, if any, and with particular regard to body weight, would result from off-wintering ewe lambs from a hill farm in a coastal area where the snow hazard is slight, and on which in recent years all the stock ewe lambs have been wintered at home on the natural hill grazings without supplementary feeding.

The farm, which is heavily infested with the sheep tick (*Ixodes ricinus L.*), is situated on the Ardnamurchan peninsula on the west coast of Scotland, and runs from the sea-shore up to about 900 feet. There are two hirsels, one carrying some 600 ewes and a smaller one with about 200 ewes. The available soil cobalt has been reported as being above that of deficient soils, and deficiency has never been recognised in the sheep stock. The smaller hirsel is rougher, poorer and more lightly stocked than the large one, and while the lambs from the two hirsels have usually been about equal in weight up to the time of marking in June, thereafter, when they are more dependent on grazing, those from the larger hirsel have usually grown better and been several pounds heavier at weaning time.

It seemed, therefore, that any benefit to be derived from off-wintering might be more apparent in the lambs from the poorer hirsel, and these were used in the present trial.

Experimental

Forty-eight ewe lambs from the small hirsel were available on October 5, 1949, after the normal culling of very small lambs and any otherwise considered unsuitable for stock.

The lambs were divided into two groups of 24, Group H to be wintered at home on the hill grazings, and Group O to be wintered off the farm. In selecting the groups, the lambs were first numbered on the horn, weighed and then paired as nearly as possible for weight, one of each pair being allocated provisionally to each group. The groups were then inspected for evenness, and since sheep of the same weight may vary considerably in height and fleece character, a few individuals were interchanged until there remained little difference between the groups that could be detected by three experienced men. As numbers branded on the horn become indistinct in time, particularly in young

sheep when the horns are still growing, all the sheep were tattooed on the under side of the tail at shearing time in 1950. Both groups were dosed with phenothiazine and carbon tetrachloride and Group H returned to the hill grazings. During the tupping season this group was isolated in an enclosure of unimproved hill grazing.

Group O was retained for a fortnight on good quality aftermath grazing and then moved by road to winter grazing at West Drums, Brechin, on the east coast of Scotland. This farm, which is free of ticks, is devoted largely to the raising of pedigree beef cattle and the grazings appear well suited for lamb wintering. The fields selected were those likely to winter the lambs reasonably "hard," older leys being used with the object of keeping the lambs in fair thriving condition but it was not intended that very marked weight gains should be made because of the general belief that lambs wintered too well tend to thrive badly on their return to the hill grazings. The lambs received no hand feeding except for a little hay on one or two days when the ground was snow-covered. Very little of this was eaten and they subsisted *de facto* on grass for the whole period.

On April 12, 1950, at the end of the wintering period, the lambs in Group O were weighed at West Drums, vaccinated against louping-ill and dipped in a DDT/Gammexane dip to prevent massive tick infestation, since they were to return to the hill grazings during the peak period of tick activity. They returned to the original hill grazings on the following day.

On April 15 Group H was weighed and dipped and the two groups were compared side by side. Thereafter both groups were returned to the hill and remained there until June 22 when they were weighed and shorn and the fleeces weighed. They were weighed again a month later on July 24 and again on November 25, 1950. On that day both groups were returned to the hill with the rams for service along with the rest of the flock.

The sheep then remained on hill grazings until April 25, 1951, when they were weighed and examined for pregnancy by palpation of the abdomen and inspection of the udder. As lambing had just begun, pregnancy could be diagnosed with a high degree of accuracy in this way. The sheep were weighed again when the lambs were weaned in September, 1951.

It is almost impossible to ensure a complete gathering of all the sheep on an unfenced hill at one attempt, and usually a few sheep were missing at each weighing. The home-wintered sheep were worst in this respect as they were more widely scattered over the hill and tended to stay near the area on which they were reared. The off-wintered group were distributed less widely and tended to graze as a group on grazings nearer home and were therefore more easily gathered.

Results

Mortality.

No loss occurred in either group during the winter 1949-50. From previous experience a loss of five to ten per cent might have been expected in Group H and a five per cent death rate is not uncommon in off-wintered lambs such as

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TABLE I

Weight (lb.)

Group H (Home-wintered)						Group O (Off-wintered)					
No.	5.10.49	15.4.50	22.6.50	24.7.50	25.11.50	No.	5.10.49	12.4.50	22.6.50	24.7.50	25.11.50
21	51	46	—	69	66	70	50	55	73	66	73
00	52	41	61	55	61	82	52	60	78	71	73
22	52	46	65	59	65	87	52	59	74	68	72
76	53	47	58	51	52	18	53	58	78	72	81
77	54	50	70	63	71	65	53	66	83	83	88
25	55	50	72	68	80	61	54	63	73	70	77
80	55	47	77	73	82	62	56	64	76	69	76
26	56	45	69	65	76	27	56	56	74	72	82
86	56	48	71	65	—	20	57	62	78	71	76
11	58	48	71	71	77	52	57	61	76	72	73
50	60	—	71	66	74	88	58	65	80	76	78
12	61	57	83	80	93	51	60	65	78	77	84
08	62	—	75	71	78	02	61	65	78	77	83
75	62	49	74	72	90	05	62	57	75	73	84
07	63	60	84	75	85	67	63	71	87	87	83
58	63	54	75	67	82	81	63	70	88	79	88
66	64	52	79	72	79	17	64	66	88	86	93
85	64	54	78	73	79	57	64	63	80	75	78
15	65	48	77	73	88	16	66	71	84	78	91
78	66	56	81	72	78	71	67	69	85	77	dead
68	66	58	74	70	86	28	70	74	92	89	96
01	70	60	86	83	91	06	71	73	90	86	87
60	71	61	85	81	95	10	72	68	85	82	77
72	75	59	87	82	94	56	76	74	96	88	93
Av.	60.6 (24)	51.6 (22)	74.9 (23)	69.8 (24)	79.2 (23)	Av.	60.7 (24)	64.8 (24)	81.2 (24)	76.8 (24)	82.0 (23)

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Group O. By November, 1950, Group O was reduced to 23. By April, 1951, one sheep in Group H and two in Group O had died, and by September, 1951, when the sheep were approximately 2½ years old, Group H was reduced to 22 and Group O to 19. Over a period of two years, therefore, there had been two deaths in Group H (8.3 per cent) and five in Group O (20.8 per cent).

General Appearance.

In October, 1949, the two groups had been very evenly matched for weight (Table I) and general appearance. At the end of the winter when the groups were inspected side by side there were marked differences between them. The sheep in Group O looked larger in all dimensions, the fleece was longer and heavier and the development of the head and particularly of the horns was much greater than in Group H.

By November, 1950, when the sheep were about 18 months old and had been on hill grazings together for about seven months, much of the difference between them had disappeared. When the groups were inspected separately the sheep in Group O looked bigger on the whole and more even in size, but when the two groups were mixed and an attempt was made to allocate the sheep individually to each group, the shepherds were unable to do this with any degree of accuracy, except that the smallest sheep could be allocated with more certainty to the home-wintered group. The main difference between the groups then appeared to lie in the greater variation in size within Group H due to the presence of more small lambs in this group than in Group O.

Fleece Weights.

Each fleece was weighed immediately after shearing on June 22. The average fleece weight in Group H was 4.4 lb. and Group O 4.7 lb., a difference of only seven per cent, which corresponds roughly with the difference of eight per cent in body weight between the groups at shearing.

Weight Changes.

At the initial weighing on October 5, 1949, the average weight of the 24 sheep in Group H was 60.6 lb. (range 51 to 75 lb.) and of Group O 60.7 lb. (range 50 to 76 lb.) (Table I).

At the end of the wintering period in April, 1950, there was a difference of 13.2 lb. in the average weights of the groups, due partly to a gain of 4.1 lb. (6.7 per cent) in Group O but mainly to an average loss of 9.0 lb. (14.8 per cent) in Group H. The two sheep missing from Group H in April, 1950, had weighed 60 and 62 lb. in October, 1949, close to the average weight at that time, and it is, therefore, unlikely that their absence introduced any serious error in the average weight in April, 1950.

By June 22, when both groups had been on hill grazings for about ten weeks, the weight difference had narrowed from 13 lb. to 6.3 lb., Group H having gained an average of 23.4 lb. and Group O 16.4 lb. since the April weighing. A month later on July 24 both groups were weighed again and both were lighter then than in June. Even when allowance is made for the weight of

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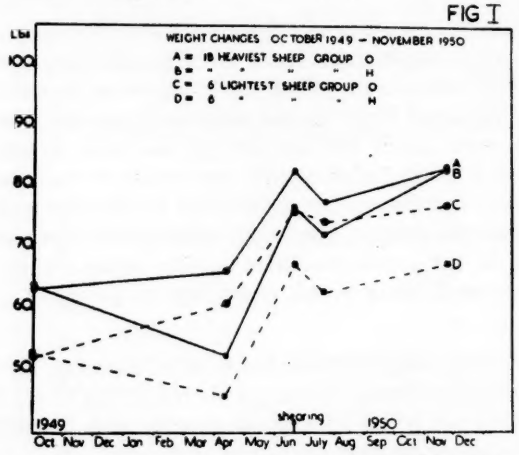
the fleece removed in June, there had been practically no change in weight in the preceding month, Group H having lost an average of 0.7 lb. while Group O had gained 0.3 lb. This was probably due to cold wet weather following shearing. The groups were weighed again on November 25, 1950, just before going with the rams for service and on that date Group H averaged 79.2 lb. and Group O 82.0 lb. These are probably not the peak weights which may have been reached some weeks earlier.

The weight difference of 13 lb. at the end of the first winter had, therefore, narrowed to less than 3 lb. by tupping time seven months later, the home-wintered sheep having gained an average of 27.6 lb. (53.5 per cent) and the off-wintered sheep 17.2 lb. (26.5 per cent) in the twenty-eight week period when both shared the same hill grazings.

FIG I



In October, 1949, the range of weights in Group H had been 51 to 75 lb. and in Group O 50 to 76 lb. In November, 1950, however, the range in Group H was 52 to 95 lb. and in Group O 72 to 96 lb. This suggests that the main differences between the two groups might be due to the sheep which were lightest at the outset in October, 1949, and supports the impression gained on inspection of the groups.

In November, 1950, when the lightest off-wintered animals weighed 72 lb., there were five home-wintered sheep below this weight (av. 63.0 lb.). All of the latter had been below the average weight of the Group (60.6 lb.) in October, 1949, their average weight then being 52.4 lb. On the other hand the five off-wintered sheep which were lightest at the outset weighed an average of 52.0 lb. in October, 1949, and 77.4 lb. in November, 1950. The respective gains of the two groups of five up to November, 1950, had therefore been 10.6 lb. in Group H and 25.4 lb. in Group O. At the other end of the weight range the five sheep in Group H which were heaviest in October, 1949 (69.6 lb.), averaged 88.8 lb. in November, 1950, and the corresponding five heaviest sheep in Group O weighed 71 lb. in October, 1949, and 88.8 lb. in November, 1950. It would

seem, therefore, that most of the remaining weight difference between the groups when the sheep were 18 months old was due to the sheep which were in the lower weight range at the beginning of the trial, the lightest lambs in Group O having retained most of the weight superiority which they established during the winter, whereas the heavier lambs in Group H had made up all, or nearly all, the difference which existed between them and the corresponding sheep in Group O. The weight changes up to 18 months of age in the six lightest sheep in each group and in the remaining sheep are shown separately in Fig. 1.

Statistical examination of the final weights by co-variance analysis, using the initial weight as the concomitant variable, shows no significant difference between the two groups as a whole in November, 1950. Taking only the seven

TABLE II

Group	No. of sheep	Average weight (lb.) Oct. 1949	Apr. 1950	Nov. 1950	Sept. 1951
Home wintered ...	21	60.4	51.3	79.8	94.5
Off wintered ...	19	60.6	64.6	82.2	92.9

lightest sheep in each group, however, there is a difference in favour of the off-wintered group which is significant at $P < .05$.

Smith (1949) showed that even where there was a marked weight difference in April, at the end of the first winter, between off-wintered sheep and those wintered at home on improved grazings, the difference tended to disappear as judged by the weights in October in subsequent years, and that appears to be the case in this trial when the home-wintered sheep ran on unimproved hill grazings (Table II). Most of the weight difference appears to be made up in the first summer on hill grazings, but most of the difference present in November, 1950, when the sheep were 18 months old, appears to have been maintained into the autumn of 1951. This is not apparent when the average weights of all the surviving sheep in each group are considered, but these fall into three classes with different summer weight gains, and the three classes are not equally represented in each group. The three classes are (*a*) non-pregnant, (*b*) lamb not reared, and (*c*) lamb reared.

There were groups of 30 to 40 sheep falling into each class on the same hill as the experimental groups in the 1950-1951 season, and of the same age, a number of sheep selected at random having been kept barren intentionally. From the time of service in November, 1950, to weaning in September, 1951, the non-pregnant sheep gained 20.0 lb., those which were pregnant but lost their lamb very soon after birth and had practically no lactation gained 15.4 lb., and those which reared a lamb to weaning gained only 3.4 lb.

When the experimental sheep are classified in this fashion (Table III) it appears that the weight difference present in November, 1950, when the sheep were 18 months old was at least maintained at $2\frac{1}{2}$ years.

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TABLE III

Class	Group	No. of sheep	Average weight (lb.) Oct.1949	Apr.1950	Nov.1950	Sept.1951
Not pregnant	Home wintered	6	59.8	48.2	75.0	97.6
	Off wintered ...	3	56.6	62.3	82.3	109.6
Lamb not reared	Home wintered	8	60.0	52.7	79.3	96.4
	Off wintered ...	6	64.2	66.5	84.5	102.8
Lamb reared	Home wintered	7	61.3	52.1	84.6	90.0
	Off wintered ...	10	59.6	64.4	80.8	82.0

Fertility and Lamb Rearing.

In April, 1951, 23 of the original 24 sheep in Group H were still alive and 17 (74 per cent) of these were in lamb. Of the 22 sheep remaining in Group O 18 (82 per cent) were in lamb. The spring of 1951 was particularly severe in this area and lamb losses were heavy both in the experimental groups and in the whole flock, many of the lambs being stillborn, or dying within a few hours or days of birth. Only seven (41 per cent) of the 17 pregnant ewes in Group H and 10 (56 per cent) of the 18 pregnant ewes in Group O reared lambs to marking time in June. The apparent slightly better performance of Group O ewes in both fertility and rearing ability is in accordance with the claims often made for off-wintered sheep, but the difference is too small in groups of this size to be significant.

Discussion

The main interest of these observations lies in the weight changes in the two groups of sheep up to the age of 18 months. In so far as the other data are concerned, the differences are not great enough considering the size of the groups and sub-groups involved, and in the bad lambing season of 1951, to permit definite conclusions.

Thus in Group O in 1951 more of the ewes were pregnant and a bigger proportion of the pregnant ewes reared their lambs, but owing to weather conditions the performance in both groups was poor and the difference between them is too small to be significant. Similarly, the death rate over the three years was higher in Group O than in Group H, which ran no risk of loss of acclimatisation. But we know from experience on this farm over a number of years both before and since the start of the experiment that losses of up to 10 per cent have occurred in the 50 to 60 ewe lambs usually retained on the hill over the winter, although in the present experiment it happened that all the 24 lambs survived the winter.

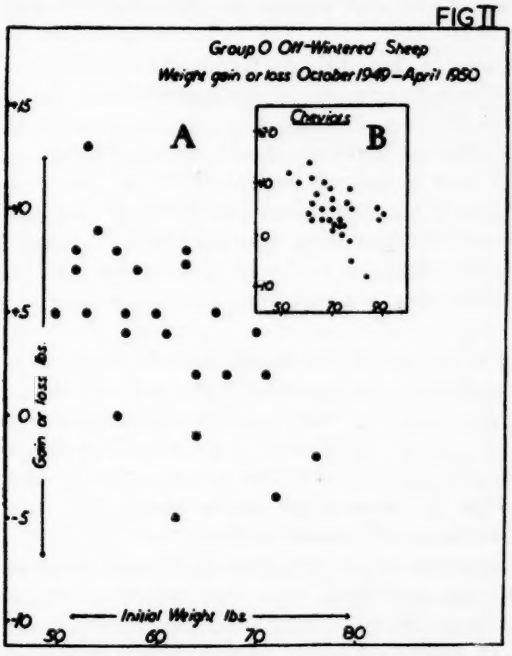
There is also evidence to suggest that the apparently higher death rate in Group O after their return to the hill grazings, which might be attributed to loss of acclimatisation, was almost certainly not due to this cause. Thus a group of 89 ewe lambs which had been bred on tick-free land and wintered at West Drums along with the experimental Group O were moved with them on to the hill grazing in April, 1950. Seventy-nine of them were still alive in October, 1952, a loss of 11.2 per cent over a period of two and a half years, whereas, in

Group O, 20.8 per cent died out of a total of 24 over a period of 18 months. If partial loss of acclimatisation were the cause of loss in Group O then the loss should have been higher or at least as high in the non-experimental group of 89 which had no prior acclimatisation at all.

It is commonly believed that off-wintered sheep yield a heavier fleece than those wintered at home. In this case, however, there was a difference of only 0.3 lb. (seven per cent) in fleece weight, although in April the fleece in Group O was considerably longer and looked much heavier than in Group H.

At the beginning of the experiment the two groups were evenly matched for weight and general appearance but at the end of the winter in April, 1950, there was an average difference of approximately 13 lb. in weight. By shearing time in June, 1950, the difference had narrowed to 6.3 lb. and by November 25, 1950,

FIG II



when the sheep were exposed for service, to 2.8 lb., a difference which is not statistically significant.

The two groups at this time appeared fairly even except for the presence of a number of rather small lambs in Group H, and this impression was confirmed by the range of weights in the two groups.

It would seem, therefore, that while sheep which were of low initial weight benefited from off-wintering and still held their weight advantage in November, 1950, sheep in the higher range and wintered at home were able to make up nearly all the difference that existed at the end of the first winter, during the following summer and autumn period on hill grazings.

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The winter grazings at West Drums therefore appear to have been good enough to produce a fairly substantial gain in weight in the small sheep, but they provided little more than maintenance for the larger sheep, and indeed four of them, including the two heaviest, actually lost weight. The greatest weight loss (8.1 per cent) occurred in lamb No. 05 which weighed 62 lb., only 1.3 lb. above the average weight of the group, at the beginning of the experiment, but at the time of weighing in April, 1950, this sheep was ill and the loss was therefore probably due to illness.

The inverse relationship between initial weight and weight gain in the sheep in Group O on the winter grazings at West Drums is shown in Fig. 2. Some confirmation of this relationship can be gained from a consideration of the weight changes in the group of 89 lambs which shared the winter grazings at West Drums with Group O and were weighed on December 10, 1949, and again on April 12, 1950.

These lambs were of three different breeds and a similar inverse relationship between initial and weight gain can be demonstrated over the whole group and within each group. The weight changes in relation to the initial weight in one breed group of 29 Cheviot lambs are shown on reduced scale in Fig. 2.

The quantity and quality of food available on the winter grazing was therefore such that only the smaller lambs in Group O were able to make gains in weight sufficiently to place them permanently and significantly above the weight of the comparable sheep in Group H, although the latter lambs did in fact make appreciably greater actual gains during the summer and autumn on the hill grazings.

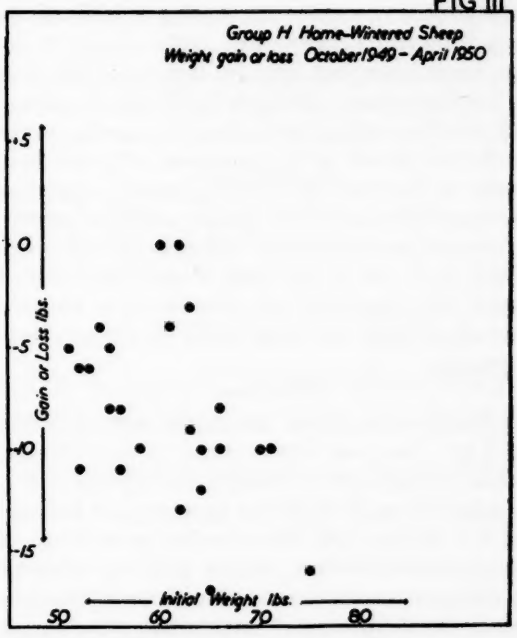
In Group H all the lambs lost weight between October, 1949, and April, 1950, the losses ranging from approximately five per cent to 26.5 per cent. On the whole the lightest lambs lost least, but the relationship between initial weight and weight change is not so well marked as in Group O in that, whilst the lowest weight losses tended to occur in the lightest lambs, a number of the lighter lambs showed losses similar to those in the heavier sheep. The weight changes in Group H in the first winter are shown in Fig. 3.

Although all except four of the sheep in Group O showed weight gains between October, 1949, and April, 1950, there may have been more widespread losses within the group than the figures indicate during the interval between weighings, since, on sheltered lowland grazings where spring grass comes early, appreciable weight increases may be made in a relatively short period towards the end of the wintering period. It seems possible, therefore, that when very small average gains are recorded in mid-April there may in fact have been quite substantial losses during the winter which were made up only in the last few weeks before the lambs returned to hill grazings. Apart from any effect this may have on size and conformation, it is possible that outbreaks of so-called " black scour " or " winter trichostrongylosis " due to worm infestation, which are common in wintering lambs, may be associated with the low level of nutrition and weight loss on poor wintering grounds.

The results of the trial described here suggest that most of the benefit

achieved by off-wintering might have been obtained by sending away not all the lambs, but only 25 or 30 per cent of them which were lightest in October, 1949. That would appear to be true at least for body weight. They also give some indication of the weight gain desirable in off-wintered lambs, and an increase of at least 15 per cent might be suggested tentatively as sufficient to raise the ultimate size of the ewes above that of those wintered on hill land. With gains of this magnitude it might be possible to determine if improvements in fertility and lamb rearing resulted from wintering under relatively good conditions.

FIG III



It would also seem that off-wintering may produce a more uniform flock by allowing the smallest lambs to make substantially greater gains over the first winter than those made by the heavier lambs, whereas small lambs wintered at home, although they tend to lose rather less in proportion to their weight than the heavier lambs and gain proportionally at least as much in the following summer, do not make great enough gross gains in the restricted summer grazing to reduce the unevenness in size within the flock.

It seems clear from published evidence that the average gains in lambs from commercial flocks sent away for the winter are not infrequently less than those recorded in this experiment. Thus Griffiths (1936) records an average loss of 1.1 lb. in 350 lambs wintered in groups on lowland grazings, though these had a reputation for doing stock well, and Davies (1950) records gains in Welsh Mountain lambs wintered at different centres ranging from 1.5 lb. (3.6 per cent) to 13.2 lb. (32.3 per cent). Jamieson (1947) recorded a gain of 13.0 per cent in

off-wintered lambs compared with a loss of 4.4 per cent in those wintered at home on specially prepared improved grazings.

When the weight gain in lambs sent away to wintering is so uncertain it is not difficult to understand why some who have stopped sending their lambs away and keep them at home on improved grazings, with hand-feeding if required, are satisfied with their results (Gibb, 1952). At the present cost of winter grazing, expenditure on the provision of accommodation and food at home seems justified. Smith (1949) has shown that most of the gains from off-wintering can be achieved by wintering at home on re-seeded hill grazings, though considerable skill and care is required in controlling the grazing to maintain the sward in good condition, including controlled grazing with cattle.

In this experiment it was not intended that the results should be followed beyond the first breeding season, although the lifetime breeding performance of the ewe may well be influenced by the method of wintering in the first year. It is appreciated also that the results are for one season only and these vary greatly in severity, but in order to demonstrate any likely benefits, apart from the avoidance of storm losses, a reasonable standard of wintering must be provided, and although the difference between home-wintered and off-wintered sheep may be very impressive in April, as it was in this case, it does not follow that any equally marked permanent advantage has been established in the off-wintered sheep, since those wintered at home can close much of the gap during the summer months on hill grazings.

Summary

Forty-eight Blackface mountain ewe lambs were divided into two evenly matched groups of 24. One group was wintered on the native unimproved rough hill grazings without supplementary feeding, and the other on grassland.

The group wintered on hill land lost 14.8 per cent in weight and those on grassland gained 6.8 per cent over the wintering period from October to April.

During the summer when both groups were on hill grazings, the lambs wintered on the hill gained more rapidly than those wintered on grassland, and in November, when the sheep were 18 months old, there remained a difference of only 2.8 lb. in favour of the off-wintered group. This difference did not reach statistical significance.

There was a significant difference between the weights at 18 months old of the seven lightest sheep in each group, and an inverse relationship between the original weight of the off-wintered lambs and their weight gain during the winter. The quality of the winter grazings had thus resulted in weight gains in the lightest off-wintered sheep which were not made up by the corresponding home-wintered sheep during the following summer, whereas the smaller gains made by the heavier off-wintered sheep were made up by the comparable home-wintered sheep.

A comparison of the weights of the ewes at the end of the first breeding season suggests that the weight difference present when the sheep were 18 months old remained at 2½ years.

The differences in mortality, fertility and rearing ability between the two

groups up to the end of the first lactation could not be attributed to the method of wintering with the small groups involved.

The results emphasise the need for winter grazings to be adequate for substantial weight gains, and it is suggested tentatively that a weight increase of not less than 15 per cent may be necessary to raise the average size of the "off-wintered" lambs permanently above that of those wintered on hill land. With such a gain subsequent differences in breeding performance might be determined.

Acknowledgments

Thanks are due to J. MacKecknie and the staff at Glenmore, Ardnamurchan, and to G. Rankin, West Drums, Brechin, for the care of the animals and assistance at handlings; to my colleague, A. A. Wilson, M.V.Sc., M.R.C.V.S., for the statistical analysis, and to the directors of Boots Pure Drug Co., Ltd., owners of the farms, for the facilities at Glenmore and West Drums.

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PROPHYLAXIS AGAINST TRYPANOSOMIASIS IN ZEBU CATTLE—USING ANTRYCIDE AND DIMIDIUM BROMIDE

By JOHN ROBSON and J. K. H. WILDE*

Veterinary Research Laboratory, Mpwapwa, Tanganyika.

THE experiments described in this paper were designed to explore the protective effect of antrycide when used in Zebu cattle exposed continuously to natural challenge by trypanosome-carrying tsetse flies. In addition to the antrycide-protected and control groups, some animals were injected with dimidium bromide (S.1553) for a comparison.

The experiments were made in two very different areas. In one, the predominant fly was *Glossina morsitans,* which was present in fairly high concentration, and in the other, the only species was *Glossina pallidipes* which was only sparsely distributed.

The animals used were Zebu oxen, all immune to East Coast Fever. In each experiment the animals were divided into three groups. One group was injected with antrycide, one with dimidium bromide and one was untreated before exposure to the tsetse fly. Those treated with antrycide received five mg. per kg. body-weight, which amount was calculated from the total antrycide in a mixed suspension made up as follows: antrycide dimethyl-sulphate 1.5 gram, antrycide chloride 2.0 gram in each 10 ml. of suspension. Those treated with

* Now at Veterinary Research Laboratory, Vom, Nigeria.

dimidium bromide received 1.5 mg. of this drug per kg. body-weight in the form of a two per cent solution. All injections were given subcutaneously.

Thick blood smears were taken at fortnightly intervals although on a few occasions the interval varied and was once as much as 42 days. After the first six months, smears from the prescapular glands were taken at the same time as those from the blood.

It was decided that some of the control animals which became infected should be allowed to die in order to assess the virulence of the trypanosomes but that in the interests of economy, attempts should be made to save others by treatment with dimidium bromide. Animals in the treated groups which became infected were given therapeutic doses of drugs, the choice of which was determined by the initial drug used in the group. Those members of the antrycide groups which became infected were treated with antrycide dimethylsulphate in 10 per cent solution at the rate of five mg. per kg. Animals in the dimidium groups which became infected were treated with dimidium bromide at the rate of 1.5 mg. per kg. body-weight.

The cattle in each area were grazed together as one herd, the groups mixing freely. Each night the herd was kraaled as a protection against lions, but during the daytime the animals were grazed and watered in the tsetse-infected bush.

The details of the experiment in each area are given separately.

Experiment A. "Glossina morsitans" area.

This was located at Mkata towards the inner margin of the coastal plain and about 150 miles inland along the Central Railway Line from Dar-es-Salaam. The grazing area was in bush of medium density alongside the Mkata River. The predominant fly was *Glossina morsitans* with *G. pallidipes, G. austeni* and *G. brevipalpis* occurring in the riverine thickets. There was a fairly large reservoir of game in the area mainly comprising reedbuck and waterbuck.

The three groups were made up as follows:—

Group (*a*)	Antrycide	32 animals.
Group (*b*)	Dimidium bromide	29 animals.
Group (*c*)	Controls	33 animals.

The prophylactic injections were given in a tsetse-free area at the beginning of October, 1949, and the animals were then moved into the tsetse-exposure area.

Group (*a*) Antrycide group—32 animals.

No trypanosomes were found in blood smears up to the 71st day, but on the 93rd day, one animal showed *Trypanosoma vivax*. From this time onward, fresh animals in this group showed trypanosomes until by the 276th day, 68 per cent were infected. On the 279th day, the infected cattle were treated with antrycide dimethylsulphate. One animal which received this treatment showed *Trypanosoma congolense* in its blood 11 days later and three more showed trypanosomes 28 days after treatment. The remainder, with the exception of one which did not break down, showed trypanosomes at varying intervals up to 210 days. Some of these were re-treated with antrycide dimethylsulphate and one animal showed trypanosomes eight days later and others at 31, 45, 59, 60 and 101 days

after the second treatment. The one animal which showed trypanosomes at eight days, was later treated with dimidium bromide and showed trypanosomes 31 days later. Another animal which showed trypanosomes at 60 days also received dimidium bromide and showed trypanosomes 17 days later.

By the 461st day after the initial protective injections all except one animal were infected (*i.e.*, 97 per cent); the remaining animal was uninfected at the end of the experiment, that is, 521 days after the initial prophylactic injections.

Three animals in this group died of causes which could not be associated with trypanosomiasis and one was killed by a lion.

Group (*b*) Dimidium bromide group—29 animals.

One animal showed *Trypanosoma congolense* in its blood on the 29th day and two more on the 71st day. By the 101st day, 65.3 per cent of the group were infected and re-treatment with dimidium bromide of the infected animals began. Two of the re-treated animals showed infection five days later, two at 17 days and two at 19 days and the rest at varying intervals up to 275 days. A further treatment was given to some of these animals and one showed infection at five days and one at 10 days. Fourteen animals showed infection by the 27th day after the second treatment. A third treatment was given to eight animals and three showed infection on the fifth day; the remainder had broken down by the 57th day. Four of these animals received antrycide dimethylsulphate, of which two showed infection 74 days later, but the other two showed no infection at that time which coincided with the termination of the experiment. A fourth treatment was given to six animals. Two received dimidium bromide and these showed trypanosomes five and 17 days later, and four received antrycide dimethylsulphate, two of which showed infection 59 days later and one 74 days later. The remaining one had not shown trypanosomes at the conclusion of the experiment. One animal had received five injections of dimidium bromide and having shown trypanosomes 101 days after the first injection, 33 days after the second, 64 after the third, 27 days after the fourth and five days after the fifth, was given antrycide dimethylsulphate; trypanosomes were present three days later, absent on the 17th day, and were again present on the 31st day.

All the animals were infected on the 337th day after the initial prophylactic injections (100 per cent) and 12 animals (40 per cent) died of trypanosomiasis during the course of the experiment.

Group (*c*) Control group—33 animals.

In the control group, eight animals showed trypanosomes in blood smears on the 15th day (seven showed *Trypanosoma congolense* and one *Trypanosoma vivax*). All were infected by the 118th day after exposure to tsetse fly. By the 121st day, fourteen deaths (42 per cent) from trypanosomiasis had occurred and the remaining infected animals were treated with dimidium bromide. Of these, one showed trypanosomes in its blood 23 days later and the rest showed trypanosomes at varying intervals up to 415 days, the majority showing infection before the 200th day. A second treatment of dimidium bromide was given and two animals showed infection on the 27th day. Six animals received a third treatment; two received dimidium bromide and showed trypanosomes five and 19

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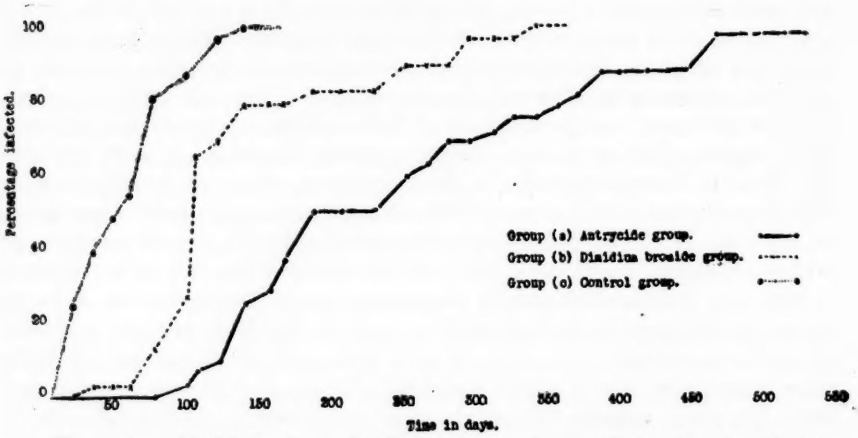
days later and four received antrycide dimethylsulphate, one of which showed infection 31 days later whilst the other three had not shown trypanosomes at the conclusion of the experiment 74 days after treatment.

The two animals which had received a third injection of dimidium bromide and had shown trypanosomes were given antrycide dimethylsulphate, and one of these showed infection on the 45th day but the other had not shown trypanosomes at the 74th day when the experiment was concluded.

Twenty-two animals (66 per cent) in this group died of trypanosomiasis.

FIG. I.

Figure showing percentage rates of infections of the three groups expressed in days after initial exposure to tsetse flies (Experiment A)



The rates of infection in each of the three groups and the time-distribution of the first appearance of trypanosomes in smears are given in Figure 1 and Table I respectively. The comparison of the incidence of trypanosomes in the peripheral circulation and in the prescapular glands is tabulated in Table II.

Experiment B. "Glossina pallidipes" area.

This area, in the Central Province of Tanganyika at Mseta, 20 miles east of Mpwapwa, had a very light infestation with *Glossina pallidipes*. The experiment was on similar lines to Experiment A, with an additional observation made each month; blood was drawn from the jugular veins of the animals into citrate and taken to the laboratory where transmissions were made into indicator animals free from trypanosomes. The object of this was to obtain information on the effect of drugs on the incubation period of the trypanosomes and also to detect any production of occult forms of the disease. This aspect of the work is reported separately.

In Experiment B. the three groups were made up as follows:—

Group (*d*)	Antrycide	22 animals.
Group (*e*)	Dimidium bromide	21 animals.
Group (*f*)	Controls	19 animals.

TABLE I

Time-distribution of the first appearance of trypanosomes in smears, expressed in days after initial exposure to tsetse flies

Group	Total No. of animals	Number of Infections	Distribution in days after treatment																Average No. of days free from trypanosomes
			0 to 30	31 to 60	61 to 90	91 to 120	121 to 150	151 to 180	181 to 210	211 to 240	241 to 270	271 to 300	301 to 330	331 to 360	361 to 390	391 to 420	421 to 450	451 to 481	
(a) Antrycide	32	New				3	5	4	4	—	4	2	2	2	2	—	2	1	236.4
		Total					8	12	16	—	20	22	24	26	28	—	30	31	
(b) Dimidium bromide	29	New	1	—	2	17	3	—	1	—	2	2	—	1					133.4
		Total			3	20	23	—	24	—	26	28	—	29					
(c) Controls	33	New	13	5	9	6													53.2
		Total		18	27	33													

TABLE II

Table showing the distribution of trypanosomes and their species in blood and gland smears

Group	Trypanosomes appearing in either blood or gland but not in both in the same animal						Trypanosomes appearing both in blood and gland in the same animal				
	In blood smears alone			In gland smears alone			T.c. in blood T.v. in gland	T.c. in blood T.c. in gland	T.v. in blood T.v. in gland	T.v. in blood T.c. in gland	T? in blood T? in gland
	T.c.	T.v.	T?	T.c.	T.v.	T?					
(a)	63	3	1	8	20	7	2	37	5	1	1
(b)	109	9	1	4	16	4	9	36	20	1	2
(c)	35	0	0	2	11	1	4	11	3	0	2
Total	207	12	2	14	47	12	15	84	28	2	5

T.c.:—*T. congolense* *T.v.*:—*T. vivax* T?:—Trypanosome undiagnosed due to sparsity or damage

The prophylactic injections were given before the animals were moved into the exposure area.

Group (*d*) Antrycide group—22 animals.

No trypanosomes were found in any smears taken from animals in this group until the 141st day, when *Trypanosoma congolense* appeared in two and *Typanosoma vivax* in one. A fourth animal showed one unidentified trypanosome only in its blood smear at the same time. Up to the 430th day five more animals in this group showed trypanosomes, three were *Trypanosoma vivax* and two *Trypanosoma congolense*. One animal which had shown *Trypanosome vivax* in the gland smears only, died. Post-mortem examination suggested that death was due to a heavy infestation with *Fasciola gigantica* and *Hæmonchus contortus* and not to trypanosomiasis.

Ten animals (45 per cent) became infected during the course of the experiment which lasted 477 days and there was one death (4.5 per cent) from trypanosomiasis.

Group (*e*) Dimidium bromide group—21 animals.

The first positive smear from this group was obtained on the 43rd day when *Trypanosoma congolense* was detected in one animal. By the 365th day, 19 had been infected and by the end of the experiment, all the animals with the exception of two which died early in the experiment, had showed trypanosomes in the blood or gland smears. Nine deaths from trypanosomiasis (43 per cent) were recorded.

Group (*f*) Control group—19 animals.

Three animals showed *Trypanosoma congolense* and five showed *Trypanosoma vivax* at the 56th day. By the 196th day all, except one animal, had been infected at least once. The exception was apparently free at the end of the experiment, that is, the 477th day, but blood from this animal inoculated into a trypanosome-free animal produced trypanosomiasis in the inoculated animal; it is probable therefore that it had an infection of trypanosomes which were not detected in smears. Ten animals (52.6 per cent) in this group died of trypanosomiasis during the course of the experiment whilst one died very early in the experiment without showing trypanosomes.

The time distribution of the first appearance of trypanosomes in smears and the comparison between the incidence of trypanosomes in the peripheral circulation and in the prescapular glands are given in Tables III and IV.

Discussion

In Experiment A, the cattle were exposed to an intensity of naturally transmitted trypanosomes which was sufficient to infect all the control animals in 118 days. This intensity was not as great as might have been expected from the number of flies present and probably represented a fairly low percentage of infection among the tsetse-fly population. Some of the animals succumbed to trypanosomiasis and had not others been treated it is reasonable to assume that more would have died. Virulent trypanosomes were therefore present in the area and the average time from exposure to infection in the control animals was

TABLE III

Time-distribution of the first appearance of trypanosomes in smears, expressed in days after initial exposure to tsetse flies

Group	Total No. of animals	Number of Infections	Distribution in days after treatment															Average No. of days free from trypanosomes
			0 to 30	31 to 60	61 to 90	91 to 120	121 to 150	151 to 180	181 to 210	211 to 240	241 to 270	271 to 300	301 to 330	331 to 360	361 to 390	391 to 420	421 to 450	451 to 480	
(d) Antrycide	22	New					4	1	1	—	—	1	1	1	—	1	—	—	226.5
		Total						5	6			7	8	9		10			
(e) Dimidium bromide	21	New		2	5	4	2	2	—	—	1	1	—	2	—	—	—	—	142.7
		Total			7	11	13	15	—	—	16	17	—	19					
(f) Controls	19	New		8	5	1	2	—	1	1									83.4
		Total			13	14	16	—	17	18									

TABLE IV

Table showing the distribution of trypanosomes and their species in blood and gland smears

Group	Trypanosomes appearing in either blood or gland but not in both in the same animal						Trypanosomes appearing in both blood and gland in the same animal			
	In blood smears alone			In gland smears alone			T.c. in blood T.v. in gland	T.c. in blood Tc. in gland	T.v. in blood T.v. in gland	T.c. in blood T? in gland
	T.c.	T.v.	T?	T.c.	T.v.	T?				
(d)	8	1	1	1	6	0	0	4	1	1
(e)	37	1	0	1	7	1	5	8	1	3
(f)	10	2	0	1	3	1	2	0	1	0
Total	55	4	1	3	16	2	7	12	3	4

T.c.:—*T. congolense* *T.v.*:—*T. vivax* T?:—Trypanosome undiagnosed due to sparsity or damage

53 days with a range of 15 to 118 days. The average length of time that the animals of the antrycide group remained free from trypanosomes, as demonstrated by blood and gland smear examination, was 236 days, varying from 93 days to the end of the experiment (521 days) when one animal still appeared to be free from trypanosomes. The animals in the dimidium bromide group also appeared to be protected but for the shorter period of from one to two months. The average length of time which the animals remained free of trypanosomes in this group was 133 days varying from 29 to 337 days.

There appeared, therefore, to be a protective effect afforded by antrycide and one of shorter duration afforded by dimidium bromide.

These results were reflected in Experiment B where the trypanosome infection rate was very low. The average length of time from exposure until trypanosomes appeared in smears from the antrycide group was 226 days—varying from 141 to 392 days. The duration of freedom from trypanosomes, including those animals which had not shown trypanosomes at the end of the experiment, was an average of 363 days. The length of time during which the animals of the dimidium bromide group, excluding the two animals which died very early in the experiment without showing trypanosomes, remained free was an average of 142 days; the range was from 43 days to 364 days. The control animals remained free from trypanosomes for an average period of 105.2 days—varying from 56 days to more than 477 days and this included one in which trypanosomes had not been detected but it must have been infected at some stage. Excluding this animal the average was 83 days.

Therefore, the length of protection conferred by the drugs was similar in both areas and this conclusion is in accordance with the results obtained by Unsworth and Chandler (1952). It must be noted, however, that the dosage of antrycide used in this experiment was lower than that subsequently decided upon by workers in East and West Africa. Davey (1950) claims protection by antrycide for a period of five to six months, based on a dosage calculated at the rate of 5.0 mg. per kg. of dimethylsulphate and 6.6 mg. per kg. of the chloride in the mixture, which is 11.6 mg. per kg. of total antrycide compared with the 5.0 mg. per kg. total antrycide (2.14 mg. dimethylsulphate and 2.86 mg. chloride) used in this experiment.

The absence of trypanosomes from the peripheral circulation or prescapular lymph gland has been taken as the criterion of freedom from trypanosomiasis in these experiments. This is, of course, open to criticism. Fiennes (1951) states that dimidium bromide and stibophen modify the course of the disease and assist recovery but do not eliminate the parasite. However, all the animals which had been protected by the drugs or treated subsequent to infection, were in excellent condition at the end of the experiment having improved considerably throughout the months of constant exposure to tsetse flies.

Drug Resistance.

One of the authors (J. K. H. Wilde) while working on the earliest phenanthridine drug to be used against trypanosomes in cattle (S.897) demonstrated that *Trypanosoma congolense* could become resistant to this particular drug.

(Hornby, Evans and Wilde, 1943). The use of drugs as prophylactics under conditions of constant exposure provides the necessary conditions for the development of drug-resistant strains of parasites. Provided that no attempt at " sterile prophylaxis " is made by repeating the drug dose at regular intervals, it may be assumed that the longer the protection given by a drug, the greater is the chance of drug-resistant strains developing. It was expected therefore, that if trypanosomes were capable of becoming " fast " to either antrycide or dimidium bromide, the experiments described above would provide the ideal circumstances for the observation of the phenomenon. Wilson (1949) demonstrated that trypanosomes which had become " fast " to antrycide resisted treatment with dimidium bromide in curative doses. Macaulay and Shaw (1950) by means of administering sub-therapeutic doses of dimidium bromide produced a strain of *T. congolense* which was resistant to this drug but amenable to treatment with antrycide.

In Experiment A described above, certain of the protected animals which had become infected with trypanosomes, when treated with either antrycide or dimidium bromide subsequently, appeared to become re-infected more rapidly than might have been expected. It was decided to carry out experiments in order to determine whether " drug-fastness " had been induced in the trypanosomes concerned.

Blood was drawn into citrate from six animals which appeared to be harbouring " drug-fast " trypanosomes. This was conveyed on ice to the laboratory where it was inoculated into Zebu cattle known to be free from trypanosomes. The transference was successful in that trypanosomes became established in the laboratory cattle from two of the antrycide-protected group and from three of the dimidium bromide group. The treatments to which these animals were subjected and subsequent results obtained are tabulated (Table V).

Both the trypanosomes which were successfully transferred from the antrycide-treated animals to laboratory cattle showed a degree of resistance to antrycide. The trypanosome transmitted from L1/66 was not eliminated by antrycide dimethylsulphate with a dose of 5.0 mg. per kg. but was apparently destroyed by a higher dosage (7.5 mg. per kg.) of the same drug. That obtained from L1/86 was resistant to the 5.0 mg. per kg. dose of antrycide and also to the normal (1.5 mg. per kg.) and the increased (2.25 mg. per kg.) doses of dimidium bromide. The indicator animal carrying this trypanosome was finally treated with stibophen (an antimonial trypanocide) but failed to respond and died. All three trypanosomes obtained from animals initially treated with dimidium bromide showed resistance to this drug but were eliminated by antrycide dimethylsulphate at the 5.0 mg. per kg. dosage level.

It appears, therefore, that drug resistance to both antrycide and dimidium bromide can be developed where animals with a waning blood concentration of these drugs are exposed to natural infection with *Trypanosoma congolense*. The results in one animal indicated that a trypanosome " fast " to antrycide might also be resistant to dimidium bromide, but the evidence regarding trypanosomes " fast " to dimidium bromide suggests that these are amenable to treatment with antrycide.

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TAB

The treatment given to six animals which harboured " drug-fast " trypanoso... and the drugs to wh...

Animal Number	Prophylactic injection and dosage rate	Showed Tryps.	Number of days after Prophylactic injection: Treated drug dose	Showed Trypes.	Treated drug dose	Showed Tryps.	Treated drug dose	Show... Tryp...
L 1/66	Antrycide (mixed salts) 5.0 mg./kg.	279	279 Antry. diM-S 5 mg./kg.	337 352 380	—	—	—	
L 1/81	Antrycide (mixed salts) 5.0 mg./kg.	136	279 Antry. diM-S 5 mg./kg.	307 352	—	—	—	
L 1/86	Antrycide (mixed salts) 5.0 mg./kg.	162 262 276	279 Antry. diM-S 5 mg./kg.	352 365 380	—	—	—	
L 1/102	dimidium bromide 1.5 mg./kg.	101 116	118 dimid. brom. 1.5 mg./kg.	307 321	325 dimid. brom. 1.5 mg./kg.	337 352 365 380	—	
L 1/105	dimidium bromide 1.5 mg./kg.	101	119 dimid. brom. 1.5 mg./kg.	152 162	180 dimid. brom. 1.5 mg./kg.	183 248 276 307 321	325 dimid. brom. 1.5 mg./kg.	
L 1/121	dimidium bromide 1.5 mg./kg.	101	117 dimid. brom. 1.5 mg./kg.	136 262 276	280 dimid. brom. 1.5 mg./kg.	290 307 321 352 365 380	—	

Tryps.: Trypanosomes Antry. diM-S: Antry... methyl...

Conclusions

In both lightly and heavily infested tsetse country, antrycide and dimidium bromide used as prophylactics gave apparent protection, but the effect of antrycide lasted significantly longer than that of dimidium bromide. Antrycide (mixed salts) appeared to keep animals free from trypanosomes as seen from fortnightly blood and gland smear examinations for an average of 230 days, while dimidium bromide had the lower figure of 138 days. Control animals remained free for an average of 68 days.

Drug-resistant trypanosomes were established in several animals and it appeared that trypanosomes resistant to antrycide were partially resistant to dimidium bromide, and trypanosomes resistant to dimidium bromide were amenable to treatment with antrycide.

...d the results of the inoculation of the trypanosomes recovered (T. congolense) *...ey are subjected*

Showed Tryps.	No. of animal into which sub-inoculation on the 180th day after Prophyl. inject.	Tryps. appear in blood	Number of days after sub-inoculation: Treated drug dose	Showed Tryps.	Treated drug dose	Showed Tryps.	Treated drug dose	Showed Tryps.	Treated drug dose
–	L 1/373	18	20 Antry. diM-S 5 mg./kg.	62	65 Antry. diM-S 7.5 mg./kg.	—	—	—	—
–	L 1/377	—	—	—	—	—	—	—	—
–	L 1/301	15 18	20 Antry. diM-S 5 mg./kg.	31 32	37 dimid. brom. 1.5 mg./kg.	48	50 dimid. brom. 2.25 mg./kg.	59 60	65 Stibophen 6.3 mg./kg.
–	L 1/322	11	12 dimid. brom. 1.5 mg./kg.	25 31	31 Antry. diM-S 5 mg./kg.	—	—	—	—
3 3	L 1/372	11	12 dimid. brom. 1.5 mg./kg.	22 28	28 Antry. diM-S 5 mg./kg.	—	—	—	—
–	L 1/371	18	20 dimid. brom. 1.5 mg./kg.	31 32	37 Antry. diM-S 5 mg./kg.	—	—	—	—

...methylsulphate dimid. brom.: Dimidium bromide.

After the initial period of protection, infections became established fairly readily and further treatment with the homologous drug was followed in many animals by diminished protection with early relapse or re-infection.

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ANIMAL HUSBANDRY, ANIMAL INDUSTRY AND ANIMAL DISEASE IN THE SOMALILAND PROTECTORATE

By ROBERT G. MARES, M.R.C.V.S.

PART II

Animal Industry

Stock Populations

Few organised attempts have been made at making a reliable estimate of the stock population. Figures given by Cocksedge (1933) in the annual report are two-and-a-half million sheep, two million goats and one-and-a-half million camels, but he does not state how he arrived at these totals. Hunt (1945) found figures appreciably less by questioning a cross-section of stock-owners in the different tribes. Next year, however, Glover (1946) produced an estimate of ten million sheep, three million goats and two-and-a-half million camels. These figures were obtained from the export figures for live animals and their hides and skins. It is generally agreed that animal exports come from stock grazed by the British-protected tribes, so it is thought that Glover's estimate must give some indication of the stock at pasture in the area defined as Somaliland in the introduction.

As this estimate of Glover's is so much larger than the earlier one of Cocksedge it might be thought that the stock population was increasing. It is very probable that the human population is increasing, but it is thought that the animal population is not keeping pace with it. The country is without doubt over-stocked, but the indications are that individual owners possess less stock than in days gone by, and often less than the needs of their families demand. This is why more and more people are drifting to the towns.

Swayne (1895) states that in 1891 68,000 sheep were sent to the garrison at Aden. To-day the annual average is about 100,000; not a startling increase. He also describes a wealth of stock in the country and says that even a lowly member of an outcast tribe could own 100 camels. It is obvious that horses are decreasing and that goats are on the increase. This is a natural trend when there is erosion and over-grazing: the most delicate animals go under and the hardiest increase. The least that can be said is that the stock population is static in spite of erosion. This is probably because the vast herds of game recorded by the first explorers have been mostly shot or driven out of the country. Unless grazing is controlled the stock is bound to move south after the game, leaving a desert behind peopled only in decaying townships by traders and civil administrators. An increased market for animals and animal products will not solve the problem, as the nomad already sells as much stock as he dare to meet his needs in clothing and rations, while maintaining an adequate bank of breeding stock to provide for his family from year to year.

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Marketing and Export

In spite of the fact that the Protectorate Government levies a tax on all stock sold in the townships not much private buying and selling goes on in the interior. This is because the nomad is only interested in selling when he is in need of rations, cloth or other necessities; or when he has to pay money to Government as a fine or for Government services.

In the towns livestock, skins, hides and ghee are all sold through a broker. In theory this man is a member of the tribe of the vendor whose job it is to act for and protect the interests of the ignorant countryman in town: in practice the broker is an undesirable middleman out for his own profit.

Fresh milk is sold direct to the public by the women without the intervention of a broker. They bring it in from the *rer* on their backs and squat on the ground in the womens' market, until it is sold. Here too they sell their mats, ropes and their various woven utensils.

Livestock is sold to the town butchers and also to the export traders for onward routing to Berbera and Aden. Some of the bigger merchants now buy stock far in the interior and herd them, or carry them on lorries, straight through to the coast for shipment. Stock is also sold back to other nomads for further grazing and fattening or for breeding. It is not usual for a sheep to change hands more than once before slaughter or export; but hides and skins may be bought and sold many times on their way from the remoter districts to the traders' stores.

The Aden export market is an important factor in the economy of Somaliland. The annual report of the Aden Veterinary Department states that 105,719 sheep were imported into Aden by sea in 1948, and that these were in much better condition than those imported from the Aden hinterland on the hoof. The sheep get handled somewhat roughly, however, in the course of shipment at Berbera as Fig. 6 shows. There are a number of deaths and injuries in every shipload. At certain seasons many sheep are sent over by Arab dhow and this may involve death from starvation or thirst if the wind fails unexpectedly. A full scale enquiry into shipping practices is long overdue.

Animal Products

Butchering. All slaughtering is done in the open air: in the townships the district officer sets aside a place for it. Men always kill camels, and women nearly always kill sheep and goats. Killing is done in the Muslim fashion by facing the throat towards Mecca and uttering the words: " In the name of God, the compassionate and compassionating," as the arteries are severed. The knife may not be withdrawn, once plunged into the neck, until its cutting is finished.

Camel carcasses are flayed and quartered on the ground by men; the meat is put on to cut thorn branches to keep it out of the dust. Old women sort and clean the offal.

Rough wooden gallows are erected for flaying and quartering sheep, which is done by women and girls (Fig. 7).

The slaughter places are kept clean by scavenging dogs and birds, and by the disinfecting action of sun and wind. Only the lungs, gall bladder, bladder

and womb rate as offal. Poorer Somali women use tripe for food, and Arab traders take the small intestines for sausage casings. It is rare to see meat fit to be condemned for any reason, and all arrangements seem to be the most hygienic practicable.

Hides and Skins. The methods of flaying leave much to be desired: a knife with a sharp point is used, and hammer flaying is little known. Hides spread on the ground to dry get burnt and dirty. Sheep are case flayed; that is the skin is taken off as a case which is pegged out to dry inside out. The belly-fold is tucked in, although the skin dries better if it is turned out, and the skin of the scrotum or udder is not cut off. These habits result in every skin having damp pockets in it which the worm, *Dermestes vulpinus,* can attack. In the interior the nomads often take up a skin before it has dried properly for fear of attracting hyenas, or because they are in a hurry to move on.

A hides and skins officer has recently started to bring about improvements in flaying, drying and marketing of hides and skins.

Meat. Camel meat is the most popular because it is thought that it imparts some of the endurance of the camel. Mutton and goat are the more often eaten. Meat is boiled and eaten from a common dish with boiled rice or sorghum. Fat, from rendering down sheep's tail, is ladled over it in quantity. Eating is done with the hands or the locally carved wooden spoons. Beef is seldom eaten, even by the cattle owners, unless there is an outbreak of rinderpest or pleuro-pneumonia, then the moribund animals are killed and the surplus meat preserved.

Preserved meat is called *mokmud.* The meat is cut up into strips and hung out to dry, or into small pieces and spread out on a grass mat. It is then cooked in ghee and stored in a gourd.

Milk and Milk Products. The mainstay of the nomad is camels' milk which is drunk fresh and freshly sour; it goes sour very quickly. It is a much relished drink, and the sight of a thirsty Somali wayfarer drinking off a foaming cup of freshly drawn milk is as inspiring as to see a thirsty Britisher drinking beer. Cows' milk is almost as popular among the cattle owners.

Surplus milk is used for making ghee. Butter is made by shaking the milk in a vessel called a *han* (Fig. 8). The butter is then clarified by slowly simmering over a low fire and the ghee spooned off as it rises. Aromatic leaves of *Lippia carveodora* (*ged hamer,* lit. red tree), may be put in as flavouring and preservative.

Dairy utensils are all made by the women from woven fibres obtained from certain Euphorbias. They are water-proofed by working fat into the texture of the weave while smoking over a fire, and this is the way that they are cleaned and reproofed for further use.

It is only the south-eastern Somali tribes so far who dry and preserve milk. When milk is to be dried it is first soured; then the curds are sun-dried, broken up or powdered and stored in a pot. It will keep for a year, and is reconstituted by mixing with five times its bulk of water. A form of cheese is also made by adding milk to a pot daily and drawing off the whey as the milk curdles. The pot is sealed when full and the contents will keep for about six months:

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Fig. 7
Somali butcher girls at work. They work slowly, but the meat is very neatly quartered.

(*Article by Mares, page 470*)

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Fig. 8

Somali girl making butter. In the background is the grass mat wall of the nomadic house.

Fig. 9

Cow with her face scarred by the Somali method of vaccination against contagious bovine pleuro-pneumonia.

(*Article by Mares, page* 470)

they may be diluted with water to make a drink or eaten as a cheese.

Ghee is the only milk product of any value commercially.

Animal Disease

General Disease Position

The health of the stock in the country is very good; a common reply to the question "How are your stock?" is "They are well, but hungry." The hard conditions make survival of the fittest the rule, and, although the Somali will hang on to a sick beast to the bitter end rather than cut his losses, this tendency does not defeat nature. If hearsay evidence is excluded a list of diseases encountered by the Veterinary Department since its foundation in 1924 is not formidable.

Charms and herbal remedies are used daily by the nomads, and superstitions about the cause and cure of disease are legion. Only those that are well confirmed or have been personally seen in use are recorded here. Plants with reputed medicinal properties are included by Peck (1952) in a collection of notes on the flora of Somaliland and their uses which it is hoped may be published.

The bases of all Somali therapeutics are soup and the hot iron. Soup is made from sheeps' heads mainly and is given in any condition where there is debility or apparent digestive disorder: it is doubtless often of non-specific value. Cautery has wider uses: as the Chinese thrust hot needles into the affected parts of their patients so too does the nomad apply a hot iron. A vast circular line of cautery around a dislocated patella is nearly as logical as firing for strained tendons; but it is difficult to see what branding over the carotoid artery can do for ear-ache, or what branding over the right kidney can do for Trypanosomiasis. In the light of this it is surprising to find that the nomad recognises the flies that spread Trypanosomiasis; that he has a good idea of the infective nature of disease, and knows that cattle with rinderpest are dangerous to other cattle; and that he has learnt logical and effective, though very primitive, methods of immunisation. These are known in other parts of Africa, and it is possible that they were introduced by Arab invaders in past times.

Somali Ways with Certain Diseases

Anthrax (*kud*). This disease is enzootic. Sudden death is the rule in sheep and goats, but in camels it often runs a protracted course with swelling of the superficial lymph glands. The nomads know that the disease is usually fatal and so kill camels showing severe symptoms for food. In spite of this dangerous habit the incidence of anthrax in man and animals is not unduly high. Old *rers* in good grazing areas are often known to be harbouring the disease and are given the special name of *degel fadi,* lit. that dwells in the dung. Attempts at cure are made with charms and cautery of the swollen glands: one or two owners come to the Veterinary Department for annual spore vaccination.

Contagious Bovine and Caprine Pleuro-pneumonias (*sambab*). This disease is well recognised by the cattle owners in the west who vaccinate against it in a way previously described (Mares, 1951 b.). The same method is sometimes

used for goats. A cow with her face scarred by the vaccination is shown in Fig. 9.

Trypanosomiasis (*dukkan*). The disease has not been confirmed in cattle, but the Somalis have a name for a wasting disease of cattle which they also use at times for the camel disease. There are many names for the disease in camels. This shows the confusion caused in the nomads' minds by the many different clinical manifestations of a chronic periodically-febrile disease: and shows too the wide distribution it has. Whenever the disease is recognised the Somali now wants treatment with "Antrypol" or "Antrycide," and he will drive his animals long distances and pay good money to get it. Frequently the disease is not recognised, and alarming reports of "new" camel disease, or of poisoning by the bait laid for locust hoppers are the result. Sometimes this is done deliberately to get the immediate attention of the Veterinary Department for a tribe that feels it has not had its share of "Antrypol," but often it is genuine ignorance. The casual organism is *Trypanosoma evansi.*

Rabies. This almost certainly occurs from time to time but has never been confirmed microscopically. Somalis know the disease and are anxious for prophylactic vaccination if they get bitten, even when it seems unlikely that the biter was rabid.

Rinderpest (*dabakarub*). This enzootic disease is well known to all cattle-owning Somalis except in the isolated pockets of cattle country in the east, where there is no history of its occurrence: in spite of this, cattle from one of these areas were resistant to artificial infection (Mares 1951 a.). Somalis in the west immunise their herds by making a soup from the urine, fæces and milk of sick animals and instilling a few ounces into the nostrils of the healthy. Many outbreaks are spread in this way, but there are already so many previously-immune cattle in every herd that a disastrous epizootic is rare. The preparation of the "vaccine" from the cattle least seriously affected perpetuates a virus strain of low virulence in the country. Every cattle owner knows the immunity status of his herd exactly, so that, when Kabete goat virus was offered for the first time on a large scale in 1951, they were most careful not to vaccinate immune animals. They claim that their "vaccine" will keep its potency if stored in a gourd for several months, but samples sent to Kenya could not be proved to have any infective power whatever (Peck, 1952).

Skin Diseases. Mange, scab and ringworm are confused in the Somali mind: *ambarr,* the word used when there is localised thickening of the skin comes to be their word for ringworm in all animals, but is most commonly applied to ringworm in camel calves; it also connotes the almost sub-clinical infection in sheep with Sarcoptes, characterised by an irritant thickening of the skin of the withers. To add to the confusion *ambarr madow* (black *ambarr*) is an undiagnosed skin disease in sheep characterised by bare black patches on the head and neck, thickened and with peripheral scabs. Numerous skin scrapings have been examined without result, and specimens sent to the Imperial Institute by Peck (1952) could not be identified. *Ado* is the name for sarcoptic mange in camels and for psoroptic mange in sheep. It is the word used when

exfoliation and scab formation are the main symptoms. Local applications for the cure of mange are the latex from *Euphorbia Somaliensis* (*enjir*), and camel urine. Most nomads, however, appreciate modern methods now, and the departmental sheep dips are kept busy during the dry season, while, at other times, the sale of coal-tar disinfectant and of "Gamatox" in bottles and pots is active.

COMPREHENSIVE LIST OF DISEASES

In the following list the Somali name, where it exists or is known, is given in italics: there follow the first traceable record of its occurrence in Somaliland (annual reports prior to 1932 were not available), and brief remarks.

Anthrax, *kud*. Cocksedge, 1932.
Black quarter, *etaiser*. Cocksedge, 1932. Clinical diagnosis only.
Caseous lymphadenitis. Peck, 1937. Sometimes seen at post-mortem examinations and at the butcheries.
Fowl typhoid. Mares, 1952. Clinical and post-mortem diagnosis only.
Tetanus. Mares, 1952. Clinical case in one camel.
Cryptococcus infection (Epizootic lymphangitis), *bisso*. Mares, 1952. Of common sporadic occurrence in the west, microscopically confirmed.
Contagious bovine pleuro-pneumonia, *sambab*. Cocksedge, 1932.
Contagious caprine pleuro-pneumonia, *sambab*. Peck, 1935.
Trypanosomiasis of camels, *dukkan*. Cocksedge, 1932.
Avian spirochætosis. Peck and Mares, 1951. Microscopically confirmed.
Piroplasmoses, *shilin*. Peck, 1938 a. Bebesia motasi confirmed, clinical cases very rare.
Coccidiosis.
  Eimeria dromedarii. Peck, 1940
  Unknown coccidia. Peck, 1952. Clinical outbreak, responding to specific treatment in European owned poultry.
Sarcosporidia. Peck, 1938 a. Found once in a sheep's heart.
Anaplasmosis. Peck, 1935. A few suspected slides only.
Ringworm, *ambarr* or *ambarr ad* Disease in camels identified as caused by Trichophyton Dankaliense by Imp. Inst. for Peck in 1937.
Foot and Mouth Disease, *abeb*. Cocksedge, 1934. No European has ever claimed to have seen this disease in person in Somaliland, but the senior Somali member of the Department, on being shown a photograph of it, said without hesitation "It is *abeb*."
Lip and leg ulceration of sheep, *afrur*. Peck, 1936. Sometimes seen.
Foot rot of sheep, *bog*. Peck, 1936. Sometimes seen.
Rabies, Cocksedge, 1932.
Sheep pox, *furuk*. Cocksedge, 1932. Common, seldom serious.
Camel pox, *furuk*. Peck, 1935. Rare.
Rinderpest, *dabakarub*. Cocksedge, 1932.
Horse sickness, *derfar*. Cocksedge, 1934. Some bad outbreaks among African owned stock in the past, nowadays only sporadic cases seen.
Three-day fever, *galab ispor* (lit. bending in the evening). Peck, 1937. Common among cattle in the West.
Mange and scab.
  Sarcoptes in sheep, *ambarr*. Mares, 1952.
  Sarcoptes cameli, *ado*. Cocksedge, 1932.
  Psoroptes in sheep, *ado*. Clinical diagnoses only.
Lice, *dæmijo*. Very common, particularly in sheep.
  Bovicola ovis. Peck, 1937.
  B. bovis. Peck, 1938.
  B. equi. Peck, 1938.
  Linognathus Africanus in sheep. Peck, 1937.
  Hæmatopinus eurysternus in cattle. Peck, 1938.
  Hæmatopinus species in horses. Peck, 1938.
Biting flies.
  Tabanus morsitans Ric., T. Kingi Aust., T. leucostomus Linn. Peck, 1937. Probable vectors of Trypanosomes.
  Pangonia rupellii Jaen. var. Margretti, P. Beckeri, P. Margretti, P. zonatus Walk., *doug*. Blood-sucking Pangonias, thought by the Solamis to spread Trypanosomiasis, probably correctly. Identifications confirmed for Peck by Imp. Inst. Ent. Lists. (Africa). Nos. 2888, 1937; 2923 and 2999, 1938.
  Liperosia minuta Bezzi. Peck, 1938.

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Hippobosca maculata, H. struthionis, H. capensis, H. camelina Savigny., *tacarta*. Peck, 1942. Identifications, by W. H. Potts, Tsetse research department, Tanganyika.

Hæmatopota coronata Aust. Peck, 1938. Imp. Inst. Ent. list 2923, 1938.

Ticks, *shilin*. Cause a great deal of trouble from direct irritation and debility, but tick-born disease is rare.

Amblyomma hebreum. Peck, 1936, in sheep and goats.

Rhipicephalus pulchellus, Peck, 1936, in dogs, camels and sheep: R. evertsi Neumann, Peck, 1937. R. simus Koch, Peck, 1939. Imp. Inst. Ent. List, 3044. R. appendiculatus Neumann. Peck, 1940. Identification by R. R. Parker, Rocky Mountain Lab. Montana, U.S.A.

Ornithodorus Savigny. Peck, 1937. Transmits relapsing fever in man, identification by Imp. Inst., O. delanoei acinus, Peck, 1939, Identification, Parker.

Hyalomma gemma Donitz., H. dromedarii, Peck, 1937., H. ægypticum Linn., Peck, 1937., Imp. Inst. Ent. List. 3044, 1939.

Argas persicus, Peck, 1938.

Tick paralysis, *gubdo* in camels, *muglo* in sheep and goats, Peck, 1935.

Helminthiasis, *al*. Cocksedge, 1932. Many of the common round and tape worms occur, but clinical disease is rare. Sheep and goats at post-mortem are often found to be worm-free, and sheep guts are popular with the Arab exporters for sausage casings because of their complete freedom from nodular worms. The few tape-worm cysts seen at the butcheries probably have their secondary stages in wild carnivora. Hydatid cysts have only been seen in camels imported from Arabia. (Peck, 1952).

Fowl paralysis, Mares, 1951. Isolated case.

Urticaria, *arro*. Mares, 1952. Similar to the condition seen in cattle in the West of England known as "blaine" or "bladder." Recovery spontaneous. Occurs in camels.

Hereditary disease, *haglo*. Peck, 1952. A leg weakness in new-born camel calves in which there is no impediment to the complete extension of the carpal joint.

Digestive diseases.

Colic. Cocksedge, 1932. In European owned ponies. Regular worming nearly eliminated it from Somaliland Camel Corps ponies. (Peck, 1942).

Diarrhœa in camel calves, *dab*. Peck, 1937. Usually due to over-ingestion of milk.

Impaction of the rumen, *jog*. Peck, 1935. Occurs in sheep and goats from eating too much dry Andropogon crytocladus and Heliotropium strigosum Wild. (*dur* and *urhad*). The Somali name means "stop" and refers not to the stoppage of the bowel, but to the way the affected animal stands about.

Poisonous plants.

Cassia occidentalis, *shuna shuna*. Peck, 1942. One instance is recorded of vomiting and diarrhœa in camels from eating this.

Euphorbia species. Most of these are poisonous but are too unpalatable to cause trouble. Leese (1927) records pharyngitis in military camels from *irgin*, one of this species.

Cyanogenetic plants. The tympany that is a symptom of this poisoning is called *balalo* and it is well known to Somalis in the farm areas. Fifteen young cattle were poisoned this year by eating young wilting sorghum (Peck, 1952). There are natural grasses as well that are cyanogenetic at certain stages of growth, among them Cynodon dactylon (*domar*), and it is thought that, as in Kenya, many unexplained stock deaths are caused in this way (Walker, 1930).

Cleome brachycarpa Forsk., *esal bukeye*, lit. "penis sick." Peck and Mares, 1952. This plant exudes an irritant oil which causes ulceration of the tip of the penis and of the sheath in young rams, and sometimes, by coitus, of the vagina. Somalis call the symptom *jabti*, their word for gonorrhœa, and buy simple ointments from the Veterinary Department which quickly alleviate the condition.

Other poisonous plants. A formidable list of poisonous plants could be compiled from Glover's check list (1947) using standard textbooks of toxicology, but the fact remains that half a dozen Veterinary Surgeons in the course of nearly thirty years have not reported any other cases than those above. Poisoning of unknown origin killed forty camels last year with symptoms of vomiting, diarrhœa and paralysis; only the sucking calves survived from the affected herd (Mares, 1952).

Conclusion

An attempt has been made to survey the animal husbandry, animal industry and animal health in the state in which they exist to-day in the Somaliland Protectorate. By starting with an introduction describing the country and the people the problems are related to the life of the stock-owning Somali. Any attempt to improve the state of animal health or animal husbandry must start with a full appreciation of the natural and human factors involved. Sympathy

with a native peoples' way of life; an understanding of their way of thought, as far as that is possible; and a knowledge of their habits with their stock are essential before any progress can be achieved.

Glossary of Somali Words

In this list the words are given first in their approximate English spelling, then follows the spelling in the orthography used in Bell's grammar, which will probably become the official spelling for the Protectorate, with the linking consonant in brackets. The meanings and spellings have been checked with the help of Mr. B. W. Andrzejewski and Mr. Musa Haji Ismail, of the London School of Oriental and African Studies.

Abeb, 'abeeb(k); foot and mouth disease.
Abud, 'abuud(k); the feed bag, the muzzle to stop a calf sucking its mother.
Ad, 'ad; white.
Addo, 'addo(d); mange.
Adi, adi(g); sheep and goats.
Af, af(k); mouth.
Af arro, ar'arro; one of the many names for symptoms of trypanosomiasis in camels. The head is drooping to the ground, hence it is called "mouth (to the) ground" or the sand.
Af rur, af ruur(k); lip and leg ulceration in sheep.
Al, 'aal(sh); helminthiasis.
Alool, alool(k); stiff mat used for making partitions in the house.
Alol, 'alool(sh); stomach.
Abjet abjed(k); the stiff mat that forms the load-taking part of the burden camel saddle.
Ambarr, 'ambaar(t); skin disease, ringworm.
Ambarr ad, 'ambaar'ad(k); white ambarr, usually Sarcoptic mange in sheep.
Ambarr madow, 'ambaar madow(d); black ambarr, undiagnosed skin disease in sheep.
Ano, 'aano(h); milk.
Ano qad, 'aano qaad; milk carried to the family on burden camels from the milking camels grazing further afield.
Ano tail, 'aano teel; the same as above.
Aqal, aqal(k); nomadic house.
Arrish, 'ariish; a house of mud and wattle.
Arori, aroori; take stock to water, verb imperative.
Arro, 'arro(d); sand, more particularly salt sand.
Arro, 'arro(d); urticaria.
Ashatan, 'ashatan(k); one day's milk turn about with the camel owner.
Ashatan, 'ashatan; to relieve one another on duty, verb imperative.
Augsulleh, 'ag ku suulleh; another word for Trypanosomiasis; lit. "foot from toe," referring to the restless pawing of a sick camel.
Aus, 'aws; all-purpose grass mats.
Aus la tida, 'aws la tid'aa; lit. grass one plaits, refers to the singing party of women to celebrate the completion of a mat, the men come to listen and flirt.
Badi, baadi(d); the strayed stock.
Badifad, baadifad(d); the reward for finding lost stock, two tobes is usually given to anyone helping in the recovery of a camel.
Bagal, baqal(k); the male mule.
Bagal, baqal(sh); female mule.
Balalo, baalallo(d); the symptom of tympany in any animal.
Baldi, baaldi(g); bucket.
Balleh, balli(g); Natural or artificially dug pool, pond or lake holding temporary water after the rains.
Bargerish, baargariirshe; a camel disease, either Trypanosomiasis or Anthrax.
Bargub, baarqab(k); stallion camel.
Biltan, biltan(k); contract or hire or one month's drinking of camels' milk.
Bisso, biso(d); cryptococcus infection in horses.
Bissod, bisad(d); cat.
Bool, buul(k); a very small aqal used as a sleeping place only, usually for an old person.
Bog, boog(t); foot rot in sheep.
Camin, kamiin(t); the first drink of camels at the wells.

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Dab, daab(t); diarrhœa in animals, particularly in camel calves.
Dabadig, dabadiig(g); dystenery (diig means blood).
Dabakarub, dabakaruub(k); rinderpest.
Dair, dayr(t); the autumn rains.
Dad, Daad(k); flood.
Dad, dad(k); people.
Damer, dameer(k); male donkey.
Damer, dameer(t); female donkey.
Damijo, dammiijo; lice.
Daq, daaq; to graze, verb intransitive.
Daji, daaji, to make to graze, of animals, verb imperative.
Daq, daaq(—); grazing, grazing area.
Dan, daan(k); watering party.
Degelfadi, digafaddi(g); an old stock enclosure or site of same known to harbour Anthrax. Lit. "dung dwelling."
Deil, diil(sh); small woven pot with lid used for milk or cheese.
Derfar, dafa' (—); horse sickness.
Dorfar, doofaar(k); wild pig.
Dermo, dermo(d); mat of palm tree fibres.
Dia, dia; Arabic word for blood money.
Dibi, dibi(g); bull or bullock.
Dig, diig(g); blood or murder.
Digo, digo(h); poles supporting the house.
Dik, diig(g); cockerel.
Doho, dooho(d); area of good grazing by virtue of its position in a place where surface water drains after rain.
Doh, dooh(—); a seasonal river, a tug, see later.
Dog, doog(g); green grass, green vegetation of any kind appearing after rain.
Doro, dooro(d); a hen, eggs. This word is used in the Mijertain only with this meaning. In the Protectorate the word means "dirt on the genitals"; hence the lewd joke among Somalis of the stranger to the Protectorate asking a girl if she had any doro.
Digag, digaagad(d); a hen.
Doulis, dawlis(k); a rope for a water bucket, now used as well for an old inner tube as a water bucket to distinguish it from the skin bucket or waddan.
Douli, dawli; verb imperative, draw water.
Dufan, dufaan; verb imperative, castrate with the knife.
Dukkan, dukaan(k); commonest word for trypanosomiasis in camels. The word is sometimes used with the suffixes ad and madow, white and black, to signify mild or acute forms of the disease.
Duke, dug(g); Trypanosomiasis.
Doug (duug(g); flies of the Pangonia species known to the Somalis as vectors of trypanosomiasis.
Ducksi, duqsi(g); fly.
Ducksi, dugsi(g); a sheltered place.
Dumbar, dambar(k); colostrum.
Durdur, durdur(k); running water, water that rises to the surface in an otherwise dry river bed.
Egad, igad(k); a she camel that has lost her calf but that can still be milked.
Ergi, arji(g); written petition.
Ergi, orgi(g); male goat.
Esal, 'isal(k); penis of a ram; there is a special name for the penis of each animal.
Faras, faras(k); horse.
Feeh, fiih(d); a condition of fibrosis usually about the feet caused in the first place by an abcess or penetrating wound.
Fofi, foofi, verb imperative, let the animals out from the enclosure in the morning.
Furuk, furuq(—); pox in all animals and humans.
Gabal, qabaal(k); drinking trough.
Galab ispor, galab is boor(k); ephemeral, or three-day, fever in cattle.
Gahsal, quasaal(sh); camels that cannot thrive away from the coast and that need frequent watering.
Gahsal, qasaal; verb imperative, wash.
Garho, qaaho(d); tuberculosis in humans.
Galaha, qallah(—); a wooden clamp that is put on the anus to induce the camel to give down her milk.
Galbaid, galbeed; west, the western districts of Somaliland.
Galof, galoof(t); a female animal that has failed to conceive.
Gaura, gawra'; ritual Moslem slaughter.
Gurah, quda' (—); Acacia spirocarpa.

Gel, geel(—); camels collective.
Gel jirreh, geel jire(h); camel herders.
Gendle, gendel(k); a water trough made from skin.
Genyo, geenyo(d); a mare.
Ghani, gaane(h); camels collective, other than milking camels.
Ghogh, qooq; state of must in the male camel.
Gindi, gendi(g); Trypanosomiasis, usually in an advanced stage.
Gogos, googoos(k); decorative mat.
Gooh, go'(—); a tobe.
Gubdo, gabdow; verb intransitive, to have tick paralysis.
Gumba, gambo(d); married woman's hair covering.
Gol, gool(k); male camel to fatten for meat.
Gol, gool(t); female camel likewise.
Goose (No orthographic spelling); gathering of neighbours to help plough in the west of Somaliland; they bring their own plough animals and afterwards the man helped kills a camel and there is a feast.
Gundi (No orthographic spelling); a pair of plough oxen.
Gogob, qoqob(k); dividing partition between the pens of the stock of different owners within the main thorn enclosure.
Guri, guri(g); the house, the house and chattels complete, a collection of houses.
Gur, guur(k); marriage.
Gurning, guurniin(k); the packing and moving house.
Gurso, guurso; verb intransitive, to marry.
Gurgur, gurgur(k); the rations, bags of grain, gourds for meat, containers for milk of the nomadic household.
Gu, gu(g); the main rains, the season, April to June, in which they fall.
Guban, guban; the coastal plain.
Hadub, haduub(k); the woven container used as a milking pail.
Hadig, hadig(g); rope.
Hagar, hagaa(g); the windy summer season from July to September.
Haglo, haglow(h); hereditary deficiency in check ligament in camel calves.
Haisimo, haysiimo(d); letting an animal copulate.
Hakama, hakame(h); bridle.
Hal, hal(sh); she camel.
Hamil, hamil(k); apron for stopping the ram from copulating.
Han, haan(k); the large woven container for milk or water.
Hangol, hangool(k); crooked stick for handling the thorn branches when making the stock enclosures, general purpose crook.
Hared, hareed(d); rain water.
Harad, haraad(k); thirst.
Harag, harag(g); skin of sheep and goats.
Hargod (No orthographic spelling); yoke for a pair of plough oxen.
Haud, hawd; south, the southern districts of Somaliland.
Hergeye, hergeeye(h); man grazing stock.
Hersi, hirsi(g); Koranic text worn as amulet.
Hero, hero(d); camp or enclosure.
Herio, heeryo(d); complete burden camel saddle.
Hilib, hilib(k); meat.
Hohob, hohob(k); grass mat with pattern woven into it with silk or wool.
Hola, Hoolo(h); livestock.
Hudon, huddun(t); navel.
Hudon hed, huddunhid(k); a young animal, usually a camel, ear-marked for a new-born son by a piece of navel cord in a small leather wallet hung round its neck.
Ida, ido(h); sheep and goats, collective.
Irman, irmaan(k); milking camels, collective.
Jilal, jilaal; the dry winter season, January to March.
Jilib, jilib(k); knee joint, sub-section of a tribe.
Jog, joog; Verb imperative, stop; used as a noun for the disease symptom of impaction of the rumen.
Jogi jogo, joogi joogo; skin of a dead cow-calf stretched on a frame to stimulate the mother to go on giving her milk.
Jub, jab(t); gonorrhœa in humans, inflammation of the tip of the sheath in rams.
Kabal, kabaal(k); saddle tree of four crossed sticks.
Kailin, qaalin(t); a cow or she-camel before the birth of the first calf.
Karan, karan; rain during the hagar season.
Kardas, qardaas(k); Koranic text worn as amulet.
Kareb, karreeb(k); herd of young camels.
Kibit, kebed(d); the soft under mat of the burden camel's saddle.

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Kjaleh, ja'le(h); noise made by the cracking of the whip used to scare birds off the crops.
Kora, koore(h); saddle
Kor, koor(t); wooden camel bell.
Kud, kud(k); Anthrax.
Laed, Layd(d); young breeding ewe.
Lah, lah(d); the whip that is cracked to make the noise kjaleh.
Lama, lamma(d); hides used to keep the rain out of the house.
Lis, lis; verb imperative, milk for other people.
Loh, lo'(d); cattle collective.
Lol, lool(k); small hoop-like supports for the matting roof of the house.
Madow, madow; black.
Mag, mag(t); full blood money. one hundred camels.
Mag nagod, mag naagood; women's blood money, fifty camels.
Makar, maqaar(k); skin of a dead calf used to stimulate let-down of milk in the bereaved she-camel.
Makar sar, maqaar saar(k); the same when put over a foster calf.
Mal, maal; milk for oneself, verb imperative.
Mark, maraq(—); string used for tying up camels' teats to stop the calves sucking.
Maowis, ma'aawis(t); loin cloth.
Melig, maliig(t); one of the words for Trypanosomiasis in camels, also used for a syndrome that might be the disease in cattle.
Mir, mir; verb imperative, graze by night, attack by night.
Mokmud, muqmad(d); chopped and dried meat cooked and preserved in ghee.
Mahawish, mahawish(k); bridal cake of boiled meat and spices.
Muglow, muglow(g); tick paralysis.
Nad, naad(k); drinking trough made of skin supported on sticks.
Nol, nool(k); livestock.
Noug (no orthographic spelling); a plough.
Obo, ubbo(d); a gourd.
Obob, 'o'ob(k); skin of a dead calf stretched on a frame as jogi jogo.
Ocoleh, oxole(h); wooden water pots.
Od, ood(d); the thorn enclosure of the nomadic farmstead.
Ogo, oogo; the well area of Somaliland on the plateau.
Qadad, qadaad(k); bitter.
Qod, qood(k); masculinity, male sex.
Rakab, rakaab(k); stirrup.
Rakub, rakuub(k); riding camel.
Rakad, rakaad(d); second drink of the camels at the wells.
Rer, reer(k); house and thorn enclosure.
Ri, ri(d); she goat.
Riman, rimman; pregnant.
Riya, riyo(h); goats.
Sah, sa'(—); cow.
Sabein. sabeen(t); ewe lamb.
Sagali, sagaalay(d); standard value camel when assessing compensation after a fight, equal to nine sheep.
Sambab, sambab(k); a lung, any pneumonic disease, in particular bovine pleuro-pneumonia.
San, saan(t); hide of camel or cattle.
Sari, saari(d); mats and house supports.
Shalmad, shalmad(d); saddle cloth.
Shekamad, shakamad(d); ornamental headstall.
Shilin, shilin(t); a tick, often a tick-borne disease.
Shimber, shimber(t); a bird, a mental disease of camels, undiagnosed.
Subag, subag(g); ghee.
Sumad, sumad(d); a brand.
Sumal. sumal(k); breeding ram.
Tackar, takar(t); Hippobosca camel flies.
Toon, tun; verb imperative, castrate by hitting the cord.
Tug, too(g); dry river bed, sometimes used for the spate that flows down same.
Tug, tuug(g); a thief.
Urad, 'urad(d); that has given birth, of animals only.
Urad, 'urad(d); firstborn son.
Waba, wabah(h); morning after the camels have watered.
Waddan, wadaan(t); skin bucket.
Walan, waalan; mad, used as a suffix to mean rabies.
Wan, wan(k); ram, general term, not a breeding ram.
Wanan toomeh, wanan tume(h); instrument for castrating rams and goats by beating the cord.
Warabi, waraabi; verb imperative, water stock, water a garden.
Yerad, yarad(k); bride price in stock.

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STUDIES ON HÆMORRHAGIC SEPTICÆMIA OF CATTLE

I. Naturally Acquired Immunity in Siamese Buffaloes

By R. V. S. BAIN, B.V.Sc., M.Sc.
Department of Veterinary Pathology and Bacteriology, University of Sydney

Introduction

WHEN preliminary studies were made on *Hæmorrhagic septicæmia* of cattle in Thailand, many of the buffaloes purchased for experiment were already immune to challenge with a virulent culture of *Pasteurella multocida* type I (Roberts, 1947). The immunity was not caused by previous vaccination. The observations recorded arose incidentally when vaccine trials were started in Thailand in 1953 and are not the results of a planned investigation. In paper II of this series a simple agglutination test is described by which naturally immune animals can be identified.

Incidence

Two hundred and sixteen water buffaloes from four different districts were purchased for preliminary experiments. They were mostly four to five years of age and none was supposed to have been vaccinated, though it is possible that some of the older animals had been a few years earlier.

The sera of the first 26 animals were subjected to an agglutination test using a formalinised bacterial suspension. No reactions occurred and the animals

were allotted to groups for preliminary experiments. It was learned later that formalin is inhibitory in the agglutination test except in very low concentrations and the results of the tests were thereby meaningless. It became apparent that the animals were not uniformly susceptible when inoculated with virulent culture; some were highly resistant. The agglutination test described in the next paper was then worked out. As briefly reported by Bain (1954) 32 out of the remaining buffaloes were capable of withstanding a subcutaneous challenge of approximately 50,000 lethal doses. Immune animals were found from all four districts and age had apparently no influence.

The agglutination test was later applied to the sera of old cattle and buffaloes from North-East Thailand slaughtered at Bangkok abattoir. Of 200 tested, 170 were judged immune and could be expected to resist a challenge of 50,000 lethal doses of *P. multocida* type I (Boonmongkol, 1953).

Significance of Low-level Serum Reactions

By low-level reactions are meant those showing slight (+) to moderate (++) deposits in the agglutination test without noticeable clearing of the supernatants. Sixteen buffaloes with reactions of this type were challenged with doses ranging from 50 to 50,000 L.D. and all died.

Of 190 buffaloes tested for inclusion in vaccination experiments 13 were negative by serum agglutination tests. It would have been difficult to obtain a large number of negative animals, so nearly all those used had some agglutinins. (A check on cattle sera in Australia showed 28/200 as having similar low titre agglutinins though *P. multocida* type I is unknown there.) Any previous immunity would be a complicating factor in vaccination experiments. Animals with waning immunity might be expected to show an anamnestic reaction when vaccinated. This was noticed in 2/8 buffaloes which received adjuvant vaccine, their agglutinins rising on the second day after injection.

Origin of Naturally Acquired Immunity

Three possibilities were entertained: that the animals had actually been vaccinated, that they had experienced sub-clinical infection with normal virulent strains, or that they had been infected with an avirulent but immunising strain of pasteurella.

Possibility of Vaccination.

A government herd of 125 buffaloes was submitted to the agglutination test. These animals were regularly vaccinated with 10 ml. of a broth bacterin at six-monthly intervals, according to the manager. The last vaccination had taken place five months previously. In the test, two showed reactions and the remaining 123 low-level reactions (mostly one plus or less). The results were in general much lower than those found in any other group of non-vaccinated buffaloes examined.

Of the buffaloes purchased for the experiments, few were likely to have been vaccinated as they were bought from areas where no vaccination had been carried out for some years. It is always possible that some of the older animals

had been done. However, the results of laboratory experiments with bacterins in the past and the results of the test on the government herd quoted about make it most unlikely that naturally acquired immunity is actually caused by vaccination.

Possibility of Sub-Clinical Infection.

It is difficult at present to affirm or deny this possibility. The lethal dose of *P. multocida* type I for cattle is small—about 10,000 young bacteria by subcutaneous injection. Doses smaller than this are unlikely to stimulate the antibody mechanism. In titration experiments one ox and two buffaloes, each of which had received a sub-lethal dose, were examined for agglutinins two to three weeks later. No increases were found and the animals were still susceptible to infection by challenge. In three challenged vaccinated buffaloes which showed little local reaction to a 50 L.D. dose no rise in agglutinins was found in daily tests for the ten days after challenge.

Possibility of Infection with Avirulent Variant.

No proof is offered on this point as no such variant has been isolated, but the hypothesis is attractive because of its simplicity.

At Pakchong in 1954, 16 buffaloes were included in part of a vaccination experiment. All the animals were submitted to the agglutination test several times, over a period of four weeks, and judged to be susceptible. Twelve were vaccinated with a dead adjuvant vaccine and four were left as controls. They were in contact with about 100 assorted cattle and buffaloes and were not strictly segregated. After three months all were challenged with 25,000 L.D. The four controls survived and seven of the twelve vaccinated animals died. Serum tests of the control animals before challenge indicated some immunity. It is suggested that during the three months at Pakchong all the animals were exposed to an avirulent infection capable of immunising, but only the controls were able to acquire the infection; the vaccinated buffaloes were "immune," but not sufficiently so to resist 25,000 L.D. of virulent culture.

The low serum agglutination reactions in the 125 regularly vaccinated buffaloes from the government farm suggest that these animals were not getting the same antigenic stimulus as unvaccinated buffaloes in the country at large. The numbers tested are too small for any conclusions. A possible interpretation is that the regular vaccination was preventing infection with an avirulent immunising strain. Unfortunately, animals were not available for challenge or for further experiment on this point.

Discussion

The facts reported herein relate to an unexplained phenomenon. Roberts (1947), Hudson (1954), and the author in unpublished experiments, find that *P. multocida* type I has little relationship to other defined pasteurella types on the basis of mouse protection tests, and that type I strains are confined to cattle and pigs. Carter and Byrne (1953), however, using quellung and precipitin reactions, group bovine and avian strains together. It would be interesting to

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know the pathogenicity of these avian strains for cattle. Three bovine strains (type I) tested by Bain in Burma and Thailand were non-pathogenic for ducks and chickens in large doses of up to 1.0 ml. although one of the strains, " Insein," killed cattle or buffaloes in doses of 0.00001 ml. of a six-hour broth culture. Avirulent strains of type I would not be found by the methods used as a routine for diagnosis of pasteurellosis in S.E. Asia. When pathological material is examined at all it is usually inoculated into a mouse or rabbit and only strains pathogenic for these species are recovered. A project has been planned in Bangkok for the examination by cultural methods of a large number of specimens of throat mucus from slaughtered buffaloes and cattle in the hope that carriers of virulent and avirulent strains might be detected.

It is not likely that this naturally acquired immunity is found in Thailand only. In Burma where some small-scale experiments were made in 1952-3, a few " naturally immune " animals were found amongst those purchased. However, subsequent inquiries showed that most, if not all, of them had been vaccinated, possibly several times. In personal conversations workers in India and Africa have mentioned encountering naturally immune animals in hæmorrhagic septicæmia experiments but as their pasteurella strains were not typed it can only be presumed that the immunity was directed against type I as in Thailand.

Summary

A fairly high incidence of naturally acquired immunity to *Pasteurella multocida* type I is reported among water buffaloes in Thailand. The possible origin of this immunity and its significance in the conduct of experiments on hæmorrhagic septicæmia vaccination are discussed.

Acknowledgments

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"THE VETERINARY"

By R. H. A. MERLEN

Royal Veterinary College, London.

THE veterinary surgeon has never been happy about his title: the " surgeon " part is short and explicit but the qualifying " veterinary " has always been a stumbling block: even when shortened to three syllables it is a mouthful, few laymen can spell it and for some reason there are endless

objections to the abbreviation "vet." There seem, however, to be no alternatives: "animal doctor" savours too much of television, silk shirts and quackery, "cow doctor" is too bucolic, "veterinarian" is too decidedly transatlantic: "cow leech" alone might do in a pronounced arty-crafty setting of beards and meerschaum pipes.

The difficulty of finding a suitable title for those who tended sick animals seems to have confronted the classical authors also. There is complete lack of uniformity: Varro, writing about the time of the civil war between Pompey and Cæsar, makes use of the term *medicus pecorum*: a little later, Columella comes out with *veterinarius*, while Vegetius, under the second Valentinian, at a time when the language was becoming debased and polyglot, gives us *mulo-medicus*, which has a slightly derogatory ring about it. Allusions to veterinary surgeons are very rare in classical literature and only twice is the term *veterinarius* used.

The derivation of *veterinarius* presents a number of difficulties and Vial de St. Bel, in the preliminary discourse to his lectures, considers the two main arguments. The first of these is that the word derives from *veterina*, "draught cattle," and the *veterinarium* of Hyginus Grommaticus appears to have been the place where these animals were kept in camp, the horse lines. This is all right as far as it goes but it would be reasonable to expect that, following this line of thought, a *veterinarius* would have been more of a drover, groom or muleteer than anyone concerned with surgery and medicine. The other argument is to try for a derivation from *venter*, because "animals carry their loads on their bellies" . . . but we are certainly on the wrong trail here because once an animal's load, human or otherwise, gets into that position there has obviously been a major catastrophe in the saddlery department.

When the Dark Ages succeeded the fall of the Roman Empire in Europe and the Arabs took the lead in science, the term *baitar* for "veterinary surgeon" came into current use and it has always been assumed that this was a loan word from the Latin. There is, however, no valid reason why the Arabs should have borrowed the Columella term rather than those of the other agricultural writers. Investigation, moreover, into the Arabic language reveals that there is a perfectly sound triliteral verb, *betere*, "to amputate," and another, *baitere*, "to lance an abscess, or let blood medicinally"; from the second of these, *baitar* might very well be the perfectly normal *nomen agentis*. *Betere* has also survived in a slightly different form in the Ethiopic language. The same root is also to be found in the Hebrew, where *bater* means to cut up a carcase (as for sacrifice), and the occurrence of this word in Jeremiah and the book of Genesis is sufficient to give it a respectable antiquity and absolve it from the suspicion of being a word borrowed from the Latin.

Granted then that there is this root from which "veterinary" might possibly be derived, we must next examine what opportunities a Semitic word had of passing into the Latin language about the time of Columella. Carthage was a colony of Tyre and was of course populated by a Semitic-speaking people. At some unknown time before the destruction of the city by the Romans at the end of the third Punic war, Mago the Carthaginian wrote an extensive treatise

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on agriculture in 28 books. Alone, apparently, of all the works in the libraries of Carthage, this book was deemed of sufficient importance by the Roman senate to be saved from destruction and a panel of translators under Silanus rendered it into Latin. It was subsequently translated into Greek by Dionysius Cassius. It is apparent from *De Re Rustica* that Columella had studied the works of Mago with great attention: he refers to him in terms of the highest praise and expresses the greatest admiration for his precepts. The Punic language has almost completely vanished but the few fragments that remain show, as was to be expected, that it is closely related to the other Semitic tongues. It is just possible that Mago, in his original work, may have used some word similar to *baitar* to describe the veterinary surgeon and that Silanus may have introduced it into his translation in order to provide a word for which the Latin was at that time wanting. Alternatively, Columella may have had access to the original Punic version and decided that *baitar* gave a root for a word to describe the veterinary surgeon as quite distinct and apart from his medical confrère.

REVIEWS

INSECT, FUNGUS AND WEED CONTROL, by E. R. de Ong, 1953. 8½ in. x 5 in., 400 pp., 37 figs., numerous references. London: Thames & Hudson, Ltd. Price 52s. 6d. net.

THIS is a review of recent information on the control, largely by chemical means, of insects, fungi and weeds, with special reference to the United States of America. The first chapter consists of an introduction dealing partly with the use of chemicals as a protection against destructive insects and plant diseases from an historical viewpoint and partly with the classification of insecticides and fungicides. Following chapters deal with the physical properties of sprays and dusts, with recent developments in the equipment necessary for their application, and with the regulations and legislation on the labelling of proprietary products used in pest control in the U.S.A. Four chapters are devoted to the use of inorganic and organic chemicals in the form of dusts and sprays as insecticides and fungicides. Other chapters deal with the use of mineral, vegetable and animal oils, of fumigants for treating the soil or growing crops, and of plant derivatives as insecticides. There is a chapter on seed disinfectants and protecting agents and another on herbicides. There is also a chapter on the control of insect pests and diseases of forest trees. Chapter 15, comprising 28 pages, will have most appeal to the veterinary surgeon, as it deals with the control of insects, mites and ticks injurious or troublesome to livestock. The last two chapters deal with the control of household insects and rodents and with industrial insecticides and fungicides. An appendix on recent developments includes information consisting mainly of reports of successful experiments carried out during 1951 and 1952, together with a limited number of recommendations for the use of certain chemicals. In most of the chapters a general account of the principles

involved in the method of application or of the properties of the compounds concerned is given, as is also information on the chemical properties and uses of the various agents, and specific recommendations.

FARM ANIMALS IN HEALTH AND DISEASE, by W. R. Wooldridge, Ph.D., M.Sc., M.R.C.V.S., F.R.I.C., 1954. 463 pages. London: Crosby Lockwood and Son, Ltd. Price 30s.

IN the introduction to this work the author states that it was written to help the keeper of livestock to acquire the basic facts relating to health problems and to approach the task of maintaining healthy livestock with greater understanding and profit. There is no doubt that Dr. Wooldridge has achieved these aims. Farmers and small-holders will find the book easily intelligible and pleasant to read. There is no unnecessary use of scientific jargon and the book has the merit of not attempting to do the veterinary surgeon's job for the farmer; it states clearly in the text when veterinary assistance should be summoned.

" Farm Animals in Health and Disease " is divided into two parts. The first section, which occupies approximately a third of the book, considers general measures of hygiene and nutrition that promote health and resistance to disease. The three main chapters in this section, entitled " Good Health," " Ill Health " and " The Control of Disease " will serve as a valuable introduction to the study of animal diseases for the lay reader. The remainder of the work deals individually and concisely with the diseases of cattle, sheep, goats, pigs, horses, poultry and rabbits.

The book is copiously illustrated and in general the plates and diagrams are interesting and helpful.

The index is adequate, but it is to be regretted there is no bibliography of authors cited in the text. The work of the Animal Health Trust, of which Dr. Wooldridge is Director, is given considerable publicity in the text and the plates. The book is produced well and laid out clearly; it is good value for the modest price of thirty shillings.

ABSTRACT

NEOMYCIN SULPHATE IN *Salmonella Dublin*. INFECTION OF CALVES. R. S. Dickson, D.V.M. *Vet. Med.*, Vol. XLIX, No. 10, October, 1954.

TREATMENT of *Sal. dublin* infection in a group of 40 calves is reported. Neomycin Sulphate tablets were administered after other antibiotics were found ineffective. Seven animals died and the remaining 33 cases recovered completely.

D. C.

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NOTICES

The following Glaxo antibiotic preparations are reduced in price from November 1 : Veterinary Mylipen; Streptopen Uterine Tablets and Streptovex.

C. J. HEWLETT & SON, LTD., announce that they are moving to larger premises at King George's Avenue, Watford, Hertfordshire. Their new telephone number will be Watford 7761.

BAYER PRODUCTS, LTD., have moved their administrative headquarters from Africa House, London, W.C.2, to Neville House, Eden Street, Kingston-on-Thames, Surrey. Telephone Kingston 7733. A small branch office will remain at Africa House.

LEDERLE LABORATORIES DIVISION CYNAMID PRODUCTS, LTD., announce that with the release of Aureomycin to the medical profession on November 1, this antibiotic will be available to veterinary surgeons in Great Britain in a variety of pharmaceutical preparations.

WALTER GREGORY & CO., LTD., Wellington, Somerset, are marketing a new product " Hypolin " which it is claimed destroys the warble grub in the systems of cattle. The actual method of destruction of the grub is not understood, but if dosing is carried out at the correct time (approx. 5 months after gadding) the manufacturers state animals should be free of warbles and in better condition than undosed stock.

PFIZER, LTD., announce that they have made Terramycin available to the veterinary profession in this country in a convenient range of dosage forms for administration to large and small animals.

THE DISTILLERS COMPANY (BIOCHEMICALS), LTD., Devonshire House Piccadilly, London, W.1, on behalf of its distributors, announces a reduction in prices from November 1 of: Penicillin G, Sodium salt and Potassium salt (buffered); " Distaquaine " G; " Distaquaine " Fortified; " Distaquaine " Suspension; " Distavone "; Streptomycin (sulphate); Dihydrostreptomycin (sulphate); " Mixtamycin " and " Streptaquaine " solution.

Publishers' Notices

THE BRITISH VETERINARY JOURNAL, with which is incorporated THE VETERINARY JOURNAL, is published monthly, and copy for advertisements should be in the hands of the advertisement manager not later than the 20th of the preceding month, if proof is required. Tel.: Temple Bar 3386.

Letters for the Journal, literary contributions, reports, notices, books for review, exchanges, new instruments or materials, and all matter for publication (except advertisements) should be addressed to the Editor.

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